United States Department of the Interior
Bureau of Land Management

Environmental Assessment DOI-BLM-NM-F010-2015-0066

Piñon Unit M16-2410 Nos. 01H, 02H, 03H, and 04H Oil Wells Project

February 2015

U.S. Department of the Interior
Bureau of Land Management
Farmington District
Farmington Field Office
6251 N. College Blvd., Ste. A
Farmington, NM 87402
Phone: (505) 564-7600
FAX: (505) 564-7608

New Mexico • Farmington Field Office

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

TABLE OF CONTENTS

1. Purpose and Need for Action 1
1.1. Background 1
1.2. Purpose and Need for Action 1
1.3. Decision to be Made 2
1.4. Conformance with Applicable Land Use Plan(s) 2
1.5. Relationship to Statutes, Regulations or Other Plans 2
1.6. Scoping, Public Involvement, and Issues 4
2. Proposed Action and Alternative(s) 7
2.1. Proposed Action 7
2.2. No Action 20
2.3. Alternatives Considered but Eliminated from Detailed Study 20
3. Affected Environment and Environmental Consequences 21
3.1. Air Resources 21
3.2. Upland Vegetation 26
3.3. Wildlife 28
3.4. Special Status Species 30
3.5. Cultural Resources 32
3.6. Livestock Grazing 33
3.7. Environmental Justice 34
3.8. Public Health and Safety 38
4. Supporting Information 40
4.1. Tribes, Individuals, Organizations, or Agencies Consulted 40
4.2. List of Preparers 40
4.3. References 40
Appendix A. Maps 45
Appendix B. Biological Survey Report 49
Appendix C. Plats 50
Appendix D. Photographs 64
Appendix E. Reclamation Plan 70

This page intentionally left blank.

1. PURPOSE AND NEED FOR ACTION

1.1. Background

Encana Oil & Gas (USA) Inc. (Encana) has submitted four Applications for Permit to Drill (APDs) to the Bureau of Land Management – Farmington Field Office (BLM-FFO) for the Piñon Unit M16-2410 Nos. 01H, 02H, 03H, and 04H (Piñon Unit M16) oil wells project. The proposed project would consist of a total of four wells and associated facilities. The proposed action is the approval of the APDs by the BLM-FFO.

The proposed project would involve the horizontal drilling, possible production, and final abandonment of four wells that would be drilled to State of New Mexico, Navajo Allotted, and BLM-FFO-managed minerals from the Piñon Unit HZ (oil) formation (Lease No. NMNM 133481X). Each of the four wells would be permitted under an approved APD issued by the BLM-FFO. The proposed project would involve the construction, usage, and reclamation of a 6.8 acre well pad (including construction zone), a 140-foot-long access road, pullout areas, and a 10,788-foot well-connect pipeline (all of which would parallel the proposed access road and existing roads with the exception of 415-foot portion that would travel cross country). These project features would all be permitted under the aforementioned, approved APDs.

Oil and natural gas, vital components of the nation's energy supply, account for approximately 36 and 25 percent of total energy consumed in the U.S., respectively. These energy sources are used in residential and commercial buildings, in transportation, and by industry (U.S. Energy Information Administration 2012). Common uses for natural gas include space heating, water heating, cooling, cooking, waste treatment and incineration, metals preheating, drying and humidification, glass melting, food processing, fueling industrial boilers, vehicle fueling, and electricity generation. Gases such as butane, ethane, and propane can be extracted from natural gas to be used for products such as fertilizers and pharmaceuticals. Natural gas can also be used to create methanol, which is utilized in the production of formaldehyde, acetic acid, fuel cell sources, and additives for cleaner burning gasoline (Natural Gas Supply Association 2010). Most oil goes into fuels, including gasoline, jet fuel, and home-heating oil. Additionally, non-fuel compounds extracted from oil are used to develop lubricants; asphalt for roads; tar for roofing; waxes for food wrapping; solvents for paints; cosmetics and dry-cleaning products; plastics; and foams (U.S. Energy Information Administration 2012).

Approximately 84 percent of natural gas and 55 percent of oil consumed in the U.S. is produced in the U.S. Additionally, U.S.-produced oil and natural gas is also exported to other countries (U.S. Department of Energy 2011). Within the U.S., oil and natural gas reserves are concentrated within distinct fields. The BLM-FFO management area is within the San Juan Basin, one of the most prolific gas-producing basins in the country. Currently, the San Juan Basin produces small amounts of oil (BLM 2003a, 3-9).

Taxes and royalties on oil, natural gas, and carbon dioxide production contribute approximately 25 percent of New Mexico's general fund, and the oil and gas industry is one of the largest private sector employers in the State of New Mexico (State; New Mexico Bureau of Geology and Mineral Resources 2012). Additionally, the Federal government receives royalties, or a share of the production income, for extracted Federal minerals. In 2011, Federal natural gas royalties totaled over 2 billion dollars (Office of Natural Resources Revenue 2012).

The proposed project area is located within the San Juan Basin in San Juan County, New Mexico. The proposed project area is approximately 28 miles south of the town of Bloomfield, New Mexico, 9 miles northwest of the community of Nageezi, and 5 miles southwest of the Blanco Trading Post (see Figure A.1, Appendix A).

1.2. Purpose and Need for Action

The purpose of the proposed action is to allow Encana reasonable access to BLM-managed lands to develop their Federal and non-Federal mineral leases.

The need for the proposed action is established by the BLM's responsibility under the Mineral Leasing Act of 1920, as amended (MLA, 30 U.S. Code [USC] 181 et seq.), which authorizes the BLM to lease public lands for the development of mineral deposits (including oil, gas, and other hydrocarbons) and permit the development of those leases. It is the policy of the BLM, as derived from several laws, including the MLA and Federal Land Policy and Management Act of 1976 (FLPMA, 43 USC 1701 et seq.), to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs. Per 43 Code of Federal Regulations (CFR) 3160 (Onshore Oil and Gas Operations), the BLM is required to respond to a request for an APD.

1.3. Decision to be Made

The BLM-FFO will decide whether or not to issue the APDs associated with the proposed project, and if so, under what terms and conditions. Under the National Environmental Policy Act (NEPA; Public Law 91-90, 42 USC 4321 et seq.), the BLM-FFO must determine if there are any significant environmental impacts associated with the proposed action warranting further analysis in an Environmental Impact Statement (EIS). The BLM-FFO Field Manager is the responsible officer who will decide one of the following:

- To approve the APDs with design features as submitted
- To approve the APDs with additional mitigation added
- To analyze the effects of the proposed action in an EIS
- To deny the APDs

1.4. Conformance with Applicable Land Use Plan(s)

The proposed action is in conformance with the September 2003 BLM-FFO Resource Management Plan (RMP), with Record of Decision (ROD; BLM 2003b) as updated in December 2003. Pursuant to 40 CFR 1508.28 and 1502.21, this site-specific Environmental Assessment (EA) tiers into and incorporates by reference the information and analysis contained in the BLM-FFO Proposed Resource Management Plan/Final Environmental Impact Statement (PRMP/FEIS; BLM 2003a). The RMP was approved by the September 29, 2003 ROD (BLM 2003b), and updated in December 2003.

Specifically, the proposed action supports the following BLM policy:

> It is the policy of the BLM to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs, consistent with national objectives of an adequate supply of minerals at reasonable market prices. At the same time, the BLM strives to ensure that mineral development is carried out in a manner that minimizes environmental damage and provides for the rehabilitation of affected lands. (BLM 2003b, 2-2 – 2-3)

Development of energy-related ROWs, including access roads and pipeline corridors, is one of the primary activities of the BLM-FFO lands program. Such ROWs receive environmental review on a case-by-case basis (BLM 2003b, 2-11).

As required by NEPA, this EA addresses site-specific resources and effects of the proposed action that were not specifically covered within the PRMP/FEIS.

1.5. Relationship to Statutes, Regulations or Other Plans

Encana would comply with applicable Federal, State, and local laws and regulations. Necessary permits and approvals for the proposed project would be obtained prior to project implementation.

Many requirements regulating specific environmental elements are found in the appropriate elements sections of this EA (Chapter 3). Several permits, licenses, consultations, or other requirements are discussed below.

1.5.1. Clean Water Act

The proposed action is in conformance with the Clean Water Act, as amended (CWA; 33 USC 1251 et seq.).

Section 401

Under Section 401 of the CWA, an applicant for a Federal license or permit to conduct an activity that may result in a discharge into a water of the U.S. must provide the Federal agency with a Section 401 certification declaring that the discharge would comply with the CWA. The certification would be granted by the New Mexico Environment Department (NMED).

Section 402

Under Section 402 of the CWA, the U.S. Environmental Protection Agency (EPA) regulates storm water discharges from industrial and construction activities under the National Pollution Discharge Elimination System program. Permits are required if discharge results in a reportable quantity for which notification is required (pursuant to 40 CFR 117.21, 40 CFR 302.6, or 40 CFR 110.6) or if the discharge contributes to a violation of a water quality standard.

Section 404

Under Section 404 of the CWA, the EPA regulates the discharge of dredged or fill material into waters of the U.S., including wetlands. The Section 404 program is administered by the EPA and U.S. Army Corps of Engineers (USACE). Under the CWA, the USACE has jurisdiction over waters of the U.S. Waters of the U.S. are considered jurisdictional because they have a “significant nexus” to traditional navigable waters. The BLM-FFO and USACE - Durango Regulatory Office have determined that jurisdictional waters (i.e., waters of the U.S.) within the BLM-FFO planning area may include U.S. Geological Survey (USGS) watercourses (i.e., “blue lines” on USGS 1:24,000 topographic maps) and potentially tributaries to these USGS watercourses.

The proposed well-connect pipeline corridor would cross one USGS watercourse in two separate locations. This watercourse also travels through the proposed well pad from the southeast corner (corner 3) to the northwest corner (corner 6). It was determined by the BLM-FFO that this watercourse is not considered jurisdictional by the USACE.

1.5.2. National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA; 16 USC 470) requires Federal agencies to take into account the effects of their actions on historic properties, and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment. Compliance with the requirements of the NHPA is met by following the Protocol Agreement between the New Mexico BLM and New Mexico State Historic Preservation Officer, which is authorized by the Programmatic Agreement among the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (1997).

1.5.3. Clean Air Act

The Clean Air Act of 1972, as amended (CAA; 42 USC 7401 et seq.), establishes national ambient air quality standards (NAAQS) to control air pollution. In New Mexico, the NMED has adopted most of the CAA into the New Mexico Administrative Code (NMAC). The NMED issues construction and operating permits for air quality and enforces air quality regulations and permit conditions.

1.5.4. New Mexico State Regulations

The New Mexico Oil Conservation Division (NMOCD), which is in the New Mexico Energy, Minerals, and Natural Resources Department (EMNRD), regulates oil and gas operations in New Mexico. The NMOCD has the responsibility of gathering production data, permitting new wells, establishing pool rules and

allowables, issuing discharge permits, enforcing rules and regulations, monitoring underground injection wells, ensuring that abandoned wells are properly plugged, and ensuring that the land is responsibly restored. Oil and gas regulations administered by NMOCD are contained in NMAC 19.15. These regulations include the following, with which Encana would comply:

- The EMNRD requires operators to follow “pit rule” guidelines (NMAC 19.15.17) to reduce groundwater contamination from industry-related activities.
- NMAC 19.15.15 establishes requirements for well acreage spacing, obtaining approval of unorthodox well locations, and pooling or communitizing small acreage oil lots.
- NMAC 19.15.16.19 requires the disclosure of hydraulic fracture constituents.

1.6. Scoping, Public Involvement, and Issues

1.6.1. Scoping and Public Involvement

The BLM-FFO publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions within the BLM-FFO. The log is located on the BLM’s New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html).

A pre-disturbance onsite meeting, which was attended by Encana, BLM-FFO representatives, and an environmental consultant (Nelson Consulting, Inc. [NCI]), was held for the proposed project on December 23, 2014. The Huerfano Chapter House of the Navajo Nation was invited to the meeting. A public invitation to the pre-disturbance onsite meeting was also posted online (http://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_oil_and_gas/ffo_onsites.html); no private citizens or groups attended the meeting.

A BLM-FFO Interdisciplinary Team meeting was held for the proposed project on December 29, 2014.

At the aforementioned meetings, potential issues of concern were identified by the BLM-FFO and NCI.

Based on the size and scale, routine nature, and potential impacts associated with the proposed action, no additional external scoping was conducted. No public comments were received for the proposed action.

1.6.2. Issues

Issues Analyzed

The following issues were identified during internal scoping as potential issues of concern for the proposed action. These issues will be addressed in this EA.

- How would dust and equipment emissions associated with the proposed project impact air resources?
- Would drilling the proposed wells impact groundwater?
- How would vegetation clearing, proposed project activities, and final reclamation associated with the proposed project impact upland vegetation?
- How would vegetation clearing, proposed project activities, and final reclamation impact wildlife, including migratory birds?
- How would vegetation clearing, proposed project activities, and final reclamation impact the following BLM Special Status Species (SSS): Aztec gilia (*Aliciella formosa*), Brack’s fishhook cactus (*Sclerocactus cloveriae* var. *brackii*), Bendire’s thrasher (*Toxostoma bendirei*), ferruginous

hawk (*Buteo regalis*), pinyon jay (*Gymnorhinus cyanocephalus*), and golden eagle (*Aquila chrysaetos*)?

- How would surface-disturbing activities associated with construction of the proposed project impact cultural resources?
- How would vegetation clearing, proposed project activities, and final reclamation impact livestock?
- How would proposed project activities impact environmental justice?
- How would proposed project activities impact public health and safety?

Issues Considered but not Analyzed

The following issues were identified during scoping as issues of concern that would not be impacted by the proposed action or that have been covered by prior environmental review. These issues will not be analyzed in this EA.

U.S. Fish and Wildlife Service (USFWS)-Listed Species

Under Section 7 of the Endangered Species Act of 1973 (ESA; 16 USC 1531-1544), all Federal agencies are required to consult with the USFWS or National Marine Fisheries Service if they are proposing an action that may affect listed species or designated habitat. Consultation with the USFWS was conducted as part of the PRMP/FEIS to address the cumulative effects of RMP implementation (Consultation No. 2-22-01-1-389, Appendix M of the PRMP/FEIS). Based on a review of species currently listed by the USFWS as occurring in San Juan County (USFWS 2014), as well as the location of the proposed project area and habitat within the proposed project area, the potential does not exist for USFWS-listed species to occur within the proposed project area (see Biological Survey Report [BSR], Appendix B). Water for drilling would be obtained from the permitted Blanco Trading Post SJ-2105 water well; no unaccounted-for water depletions within USFWS-listed fish habitat would occur. Therefore, there is no need for additional Section 7 consultation.

Native American Religious Concerns

For the proposed action, identification efforts for Native American Religious Concerns were limited to a review of existing published and unpublished literature (e.g., Van Valkenburgh 1941, 1974; Brugge 1993; Kelly, et al. 2006), development of the site-specific Class III survey report prepared for the proposed action by La Plata Archaeological Consultants [LAC] 2015; BLM Report No. 2015 (II)011F), and a review by the BLM's cultural resources program regarding the presence of Traditional Cultural Properties (TCPs) identified through ongoing BLM tribal consultation efforts. There are currently no known remains that fall within the purview of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 USC 3001) or the Archaeological Resources Protection Act (ARPA; 16 USC 470) within the proposed project area.

Groundwater

Stimulation (i.e., hydraulic fracturing or "fracking") is a process used to maximize the extraction of underground resources by allowing oil or natural gas to move more freely from the rock pores to production wells that bring the oil or gas to the surface. Fluids, commonly made up of water (99 percent) and chemical additives (1 percent), are pumped into a geologic formation at high pressure during fracking (EPA 2004). Chemicals added to stimulation fluids may include friction reducers, surfactants, gelling agents, scale inhibitors, acids, corrosion inhibitors, antibacterial agents, and clay stabilizers. When the fracking pressure exceeds the rock strength, the fluids open or enlarge fractures that typically extend several hundred feet away from the well bore, and may occasionally extend up to 1,000 feet from the well bore. After the fractures are created, a propping agent (usually sand) is pumped into the fractures to keep them from closing when the pumping pressure is released. After fracking is completed, a portion of the injected fracking fluids returns to the wellbore and is recovered for future fracking operations (EPA 2004)

or disposal. Stimulation techniques have been used in the U.S. since 1949 and in the San Juan Basin since the 1950s. Over the last 10 years, advances in multi-stage and multi-zone fracking have allowed for the development of gas fields that previously were uneconomic, including the San Juan Basin.

Fracking is a common process in the San Juan Basin and applied to nearly all wells drilled. The producing zone targeted by the proposed project is well below any underground sources of drinking water. The Mancos Shale formation is also overlain by a continuous confining layer. The geological confining layer is the Lewis Shale formation, which is located above both the Mancos Shale and Mesaverde formations. The Lewis Shale formation provides an impermeable layer that isolates the Mancos Shale and Mesaverde formations from both identified sources of drinking water and surface water. On average, the total depth of the proposed well bores would be about 5,000 feet below the ground surface. Fracking in the Basin Mancos formation is not expected to occur above depths of 4,000 feet below the ground surface. Fracking could possibly extend into the Mesaverde formation overlying the Basin Mancos; however, the formation has not been identified as an underground source of drinking water based on its depth and relatively high levels of total dissolved solids. No impacts to surface water or freshwater-bearing groundwater aquifers are expected to occur from fracking of the proposed wells.

2. PROPOSED ACTION AND ALTERNATIVE(S)

2.1. Proposed Action

The proposed action is the BLM-FFO approval of four APDs associated with Encana's proposed Piñon Unit M16 project. The proposed project would include the drilling, production, and final abandonment of four oil wells and the construction, use, and reclamation of one associated well pad (with construction zones), one associated access road, pullout areas, and one associated well-connect pipeline corridor.

The primary objective of the wells would be to produce oil; however, it is likely that natural gas would be a byproduct.

Commencement of the proposed project would take place upon receipt of the APDs. The scheduled commencement of the proposed project could be delayed based on the issuance date of the approved APDs or drill rig scheduling.

During construction, no temporary use areas (TUAs) or staging areas would be utilized for the proposed project.

Construction plats and photographs associated with the proposed project are provided in Appendices C and D, respectively.

2.1.1. Location of Proposed Project Area

The proposed project area is located within the San Juan Basin in San Juan County, New Mexico. The proposed project area is approximately 28 miles south of the town of Bloomfield, New Mexico, 9 miles northwest of the community of Nageezi, and 5 miles southwest of the Blanco Trading Post.

The general region surrounding the proposed project area is characterized by even to gently rolling terrain. Elevation of the proposed project area ranges from 6,720 to 6,930 feet above mean sea level (AMSL). The legal location (New Mexico Principal Meridian) for the proposed project area is provided in the table below.

Table 1. Legal Land Description for Project Features

Facility	Legal Location (New Mexico Principal Meridian)		
	Quarter-Quarter	Section	Township & Range
Construction Zone	Eastern ½ of the Southeastern ¼	17	Township 24 North, Range 10 West
	Western ½ of the Southwestern ¼	16	
Well Pad			
Access Road	Southwestern ¼ of the Southwestern ¼		
Well-Connect Pipeline & Pullout Areas	Southern ½ of the Southwestern ¼		
	Western and Northern ½ of the Southeastern ¼		
	Eastern ½ of Northeastern ¼		
	Eastern and Northern ½ of Southeastern ¼	10	

The latitude and longitude and footages of the bottom hole and surface hole (wellhead) locations are provided in the table below.

Table 2. Bottom Hole and Surface Hole Locations for Proposed Wells

Wellhead/ Bottom Hole	Geographical Coordinate System (UTM, NAD83 [1])		Legal Location (New Mexico Principal Meridian)	
	Latitude	Longitude	Footages [2]	Township, Range, Section
01H				
Wellhead	36.309415°	-107.909046°	1,278 feet FSL 228 feet FWL	Township 24 North, Range 10 West, Section 16
Bottom Hole	36.321149°	-107.927281°	260 feet FSL 120 feet FWL	Township 24 North, Range 10 West, Section 8
02H				
Wellhead	36.309414°	-107.908944°	1,278 feet FSL 258 feet FWL	Township 24 North, Range 10 West, Section 16
Bottom Hole	36.325151°	-107.923539°	1,730 feet FSL 1,210 feet FWL	Township 24 North, Range 10 West, Section 8
03H				
Wellhead	36.309413°	-107.908842°	1,277 feet FSL 288 feet FWL	Township 24 North, Range 10 West, Section 16
Bottom Hole	36.292684°	-107.893558°	705 feet FSL 320 feet FEL	Township 24 North, Range 10 West, Section 21
04H				
Wellhead	36.309412°	-107.908740°	1,277 feet FSL 318 feet FWL	Township 24 North, Range 10 West, Section 16
Bottom Hole	36.299916°	-107.893094°	2,225 feet FNL 325 feet FEL	Township 24 North, Range 10 West, Section 21

(1)UTM: Universal Transverse Mercator, NAD83: North American Datum of 1983
(2)FNL: From North Line, FSL: From South Line, FEL: From East Line, FWL: From West Line

Existing and proposed oil and gas lease roads, well pads, and pipeline corridors are in the general vicinity of the proposed project area. The majority of the approximately 10,788-foot-long proposed well-connect pipeline corridor would overlap the proposed access road and other existing roadways, including County Roads 7515 and 7610. The northern terminus of the proposed well-connect pipeline ends at Encana's Good Times L10-2410 well-connect pipeline.

Maps and photographs of the proposed project area are provided in Appendices A and D, respectively. The proposed project area is plotted on the Huerfano Trading Post SW, New Mexico, 7.5-minute USGS quadrangle (Figure A.2) and the 2011 San Juan County National Agriculture Imagery Program aerial photograph (Figure A.3).

2.1.2. Description of Proposed Project

For a detailed description of design features and construction practices associated with the proposed project, refer to the APDs on file at the BLM-FFO. The plats (Appendix C) provide additional details.

Design Features and Best Management Practices

Encana would comply with 43 CFR 3160, Onshore Oil and Gas Orders, and BLM guidance and standards established in *The Gold Book: Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development* (*The Gold Book*; BLM and U.S. Forest Service [USFS] 2007).

Encana would adhere to the Conditions of Approval (COAs) attached to the approved APDs.

Vehicles would be restricted to proposed disturbance areas and existing areas of surface disturbance, such as existing roads and well pads. Construction and maintenance activities would cease when soil or road surfaces become saturated to the extent that construction equipment is unable to stay within the proposed project areas and/or when activities would cause irreparable harm to roads, soils, or streams. If equipment creates ruts deeper than six inches, the soil would be deemed too wet for construction or

maintenance. No frozen soils would be used for construction purposes or trench backfilling. Encana would use the six-step frozen ground procedure during frozen ground conditions.

The well locations would have informational signs, as required by Onshore Oil and Gas Operations regulations (43 CFR 3160).

The following general design features and best management practices (BMPs) would occur.

Control of Waste

Liquid and solid wastes would be disposed of at an appropriate waste-disposal site. The proposed project areas would be maintained in a sanitary condition. Hazardous substances would be handled and disposed of according to Federal law. Waste resulting from construction activities would be removed from the proposed project areas and disposed of in an authorized area, such as an approved landfill.

Encana would follow NMOCD “Pit Rule” guidelines and Onshore Order No. 1 (issued under Onshore Oil and Gas Operations [43 CFR 3160]).

Protection of Paleontological Resources

If a paleontological site is discovered, the BLM would be notified and the site would be avoided by personnel, personal vehicles, and company equipment. Workers would be informed that it is illegal to collect, damage, or disturb some such resources, and that such activities are punishable by criminal and/or administrative penalties.

Protection of Cultural Resources

All cultural resource stipulations would be followed as indicated in the Cultural Resource Records of Review, attached to the COAs in the approved APDs. These cultural resource stipulations could include, but would not be limited to, temporary or permanent fencing or other physical barriers, monitoring of earth-disturbing construction, reduction of the proposed project area and/or establishment of specific construction avoidance zones, and employee education.

Employees, contractors, and sub-contractors associated with the proposed project would be informed by Encana that cultural sites are to be avoided by personnel, personal vehicles, and company equipment. These individuals would be informed that it is illegal to collect, damage, or disturb cultural resources, and that such activities are punishable by criminal and/or administrative penalties under the provisions of ARPA.

In the event of a cultural discovery during construction, Encana would immediately stop all construction activities in the immediate vicinity of the discovery and immediately notify the archaeological monitor, if present, or the BLM. The BLM would then evaluate or cause the site to be evaluated. Should a discovery be evaluated as significant (e.g., eligible for the National Register of Historic Places [NRHP] or protected under NAGPRA or ARPA), it would be protected in place until mitigating measures could be developed and implemented according to guidelines set by the BLM.

Protection of Flora and Fauna, including SSS and Livestock

Because the proposed project would each disturb more than four acres of vegetation, if construction activities associated with the proposed project would occur during the migratory bird breeding season (May 15 through July 31), a migratory bird nest survey of the proposed project area would take place one to two days prior to construction. This survey would be conducted by a BLM-FFO-approved biologist following BLM-FFO protocol. If, during the nest survey or during construction, active nests are located within or adjacent to the proposed project area, the BLM-FFO biologist would be notified and project activities would not be permitted until fledging has occurred. If postponement is not an option, the operator would contact the USFWS’s Migratory Bird Permit Office regarding permitting.

The proposed project area is within the BLM-designated habitat “zone” for two BLM SSS: Brack’s fishhook cactus and Aztec gilia (BLM 2013a; Figure A.2 [Appendix A]). During the biological survey conducted by NCI, one Brack’s fishhook cactus and no Aztec gilia were identified within the proposed project area. The Brack’s fishhook cactus was located along the proposed well-connect pipeline corridor at approximate stationing 67+84. Under BLM-FFO guidance (BLM 2014b), no transplant is required for proposed projects with less than 30 Brack’s fishhook cacti.

Should any active raptor nests be observed within one-third mile of the proposed project area or should any additional SSS (listed by the USFWS or BLM) be observed within the proposed project area prior to or during project implementation, construction would cease and the BLM-FFO would be immediately contacted. The BLM-FFO would then ensure evaluation of the resource. Should a discovery be evaluated as significant (protected under the ESA, etc.), it would be protected in place until mitigation could be developed and implemented according to guidelines set by the BLM.

Wildlife hazards associated with the proposed project would be fenced, covered, and/or contained in storage tanks, as necessary. Per BLM Instruction Memorandum No. 2013-033, if any open pits or tanks are associated with the proposed project, they would be netted to prevent birds from entering them.

As stated above (Control of Waste), Encana would follow “Pit Rule” guidelines and Onshore Order No. 1.

Encana would notify the USFWS upon discovery of a dead or injured migratory bird, bald or golden eagle, or USFWS-listed species within or adjacent to the proposed project area. If the BLM becomes aware of such mortality or injury, the BLM would inform Encana. If Encana fails to notify the USFWS of the mortality or injury, the BLM would notify the USFWS. The BLM and the USFWS would then attempt to determine the cause of mortality and evaluate and identify appropriate mitigation measures to avoid future occurrences.

Livestock grazing operators in the vicinity of the proposed project area would be contacted by Encana at least 10 days prior to construction. Any range improvements (such as fences, gates, cattleguards, or waterlines) that could be impacted by the proposed project would be identified and impacts would be mitigated prior to construction. An existing fence that travels through the northwestern portion of the well pad and construction zone would be permanently rerouted around the proposed project area. If any additional range improvements are damaged during project activities, they would immediately be repaired to their former state or better.

For the proposed well-connect pipeline trench, gaps would be made in topsoil and subsoil stockpiles, where necessary, to allow for wildlife or cattle crossings.

No more than the amount of well-connect pipeline trench than can be worked on in a single day would be open at any given time. Trenches would not be left open for more than 24 hours. If a trench is left open overnight, Encana would provide a night guard to monitor the open trench and ensure that no livestock or wildlife becomes trapped.

The ends of the proposed well-connect pipeline trench would be sloped (3-to-1, horizontal-to-vertical) each night to allow wildlife and livestock to escape. If present, established wildlife or livestock trails would be left in place as crossovers. Escape ramps or crossovers would be constructed every 1,320 feet within the trench; if active livestock grazing is occurring in the proposed project area, these ramps/crossovers would be constructed every 500 feet. The escape ramps/crossovers would be constructed with a minimum 3-to-1 slope at each end. The escape ramps/crossovers would be a minimum of 10 to 12 feet wide and would not be fenced. The ends of the pipes would be plugged to prevent animals from crawling inside them. Before the trenches are closed, they would be inspected for wildlife and livestock. Any trapped wildlife or livestock would be promptly removed and released at least 150 yards from the trenches.

Protection of Water Resources

As stated above (Control of Waste), Encana would follow “Pit Rule” guidelines and Onshore Order No. 1.

Protection of Topsoil

Topsoil, which would be stripped from the surface of the proposed project area during the construction phase of the proposed project, would be stored and protected until it is redistributed during reclamation. The top 6 inches of topsoil would be segregated and wind-rowed along the edge of the proposed access road and well pad construction zone; thereby, topsoil would be stored separately from subsoil material. The topsoil would be free of brush, tree limbs, tree stumps, and root balls, but could include chipped or mulched material that is incorporated into the topsoil stockpile. Topsoil would not be stripped when soils are moisture-saturated or frozen below stripping depth. The topsoil would be used during reclamation, as described further below (Interim Reclamation) and within the proposed project’s Reclamation Plan (Appendix E).

Vehicle/equipment traffic would not be allowed to cross topsoil stockpiles.

If the proposed project area becomes prone to wind or water erosion, appropriate measures would be taken to prevent topsoil loss. Such measures could include using tackifiers or water to wet the topsoil stockpile so that a crust is created across the exposed soil.

For the proposed pipe trench, topsoil would not be used for padding the pipes and would not be mixed with excavated subsoil. Excavated subsoil would be stockpiled separately along the edge of the proposed well-connect pipeline corridor. For the proposed well-connect pipeline corridor, gaps would be made in topsoil and subsoil stockpiles, where necessary, to avoid ponding or to divert water during storm events.

Protection of the Public

The hauling of equipment and materials on public roads would comply with Department of Transportation regulations. Any accidents involving persons or property would immediately be reported to the BLM-FFO. Encana would notify the public of potential hazards by posting signage (e.g., trucks turning or construction ahead), having flaggers, or using lighted signs, as necessary.

Worker safety incidents would be reported to the BLM-FFO as required under Notice to Lessees (NTL) - 3A (USGS 1979). Encana would adhere to company safety policies and Occupational Safety and Health Administration regulations. Encana would comply with pipeline safety regulations (49 CFR 190 and 192). The proposed pipeline trench would be excavated and sloped in accordance with OSHA specifications.

The soil stockpiles and pipe string would also be used as safety barriers during construction of the proposed well-connect pipeline. If a pipeline trench is left open at a road crossing, orange safety fencing or barricades would be installed, if needed. During construction, access to the proposed well-connect pipeline corridor would be limited to pipeline construction crews.

Prevention and Control of Weeds

It would be Encana’s responsibility to monitor, control, and eradicate all invasive, non-native plant species within the proposed project area throughout the life of the proposed project. Encana would contact the BLM-FFO regarding acceptable weed-control methods. If Encana does not hold a current Pesticide Use Permit, a Pesticide Use Permit would be submitted prior to pesticide application. Only pesticides authorized for use on BLM lands would be used. The use of pesticides would comply with Federal and State laws. Pesticides would be used only in accordance with their registered use and limitations. Encana would contact the BLM-FFO prior to using these chemicals.

Protection of Air Resources

The BLM’s regulatory jurisdiction over field production operations has resulted in the development of BMPs designed to reduce impacts to air quality by reducing all emissions from field production and

operations. Typical measures could include flaring hydrocarbons and gases at high temperatures in order to reduce emissions of incomplete combustion, requiring that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored, ensuring that compressor engines of 300 horsepower or less have nitrogen oxide (NO_x) emissions limited to 2 grams per horsepower hour, revegetating areas not required for production facilities to reduce the amount of dust, and watering dirt roads during periods of high use in order to reduce fugitive dust emissions. Magnesium chloride, organic-based compounds, or polymer compounds could be also be applied to roads or other surfaces to reduce fugitive dust. Neither petroleum-based products nor produced water would be used.

Any additional dust-suppression practices would include the BLM-standard BMPs found in *The Gold Book* (BLM and USFS 2007) and the BMPs outlined in the COAs attached to the approved APDs.

Noise

Production would comply with noise standards outlined in NTL 04-2 FFO (BLM 2004). Encana would adhere to the noise stipulations, if any, included in the COAs attached to the approved APDs.

Erosion Control

During reclamation, stockpiled rocks, if available, would be placed within the reclamation area for erosion control and/or OHV control (if requested by the BLM-FFO), and/or in a manner that visually blends with the adjacent, undisturbed landscape.

Within the proposed well-connect pipeline corridor, erosion-control features, such as waterbars, would be applied as specified by the BLM-FFO Authorized Officer. If waterbars are constructed, they would follow the horizontal contour of the hillslope on which they would be placed. Spacing requirements (by hillslope grade) are provided in the table below.

Table 3. Waterbar Spacing Requirements by Percent Grade of Hillslope

Hillslope Percent Grade (%)	Waterbar Spacing (feet)
Less than 1	400
1-5	300
5-15	200
15-25	100

The placement of water- and erosion-control features within the proposed project area would be determined during reclamation. Erosion-control features would be applied as specified by the authorized BLM-FFO officer.

During the pre-disturbance onsite meeting, the following erosion control features were determined to occur during reclamation:

- Two 24-inch-diameter culverts would be installed along the access road at approximate stationing 0+05 and 1+40 (at start of access road and at entrance to well pad).
- Fifteen 24-inch-diameter culverts would be placed along the existing access road at approximate stationing 4+68, 8+32, 13+63, 21+06, 25+22, 40+46, 45+86, 50+32, 53+63, 59+37, 64+49, 68+57, 71+53, 77+16, and 80+94.
- Water would be diverted around the Piñon Unit M16 well pad from the southeastern corner (corner 3) to the southwestern corner (corner 5) and from the southeastern corner (corner 3) to the northeastern corner (corner 2).
- A 50-foot-long and 50-foot-wide silt trap would be installed near the northwestern corner (corner 6) of the Piñon Unit M16 well pad during interim reclamation.

Proposed Project Phases

During all project phases, vehicles would use the proposed access road, developed BLM roads, and highways in the region. Traffic would include light vehicles (such as cars and pick-up trucks) and heavy vehicles (such as water trucks and large tractor-trailers hauling equipment).

Refer to the section above (Design Features and Best Management Practices) for resource-protection details associated with all proposed project phases.

Under the proposed action, the following phases would occur.

Upgrade of Existing Roads

If the proposed wells are commercially viable, Encana would schedule a meeting with the BLM-FFO to discuss which portions of the existing roads, if any, would require upgrades and/or surfacing to prevent soil erosion and accommodate year-round traffic.

Existing roads would be maintained in the same or better condition as existed prior to the commencement of the operation phase of the proposed project. This maintenance would continue until final abandonment and reclamation of the proposed project area. Encana would inspect and maintain the existing roads as outlined in their Road Maintenance Plans attached to their APDs.

Approximately 8,466 feet of an existing Resource Road would be upgraded from the start of the proposed access road to where the existing road reaches County Roads 7515. The existing road would be upgraded following *The Gold Book* (BLM and USFS 2007) and BLM Manual 9113, Sections 1 and 2 (BLM 2011d and BLM 2011e).

The existing road upgrade would include the construction of four pullout areas to accommodate vehicle traffic for site mitigation safety and as a passing area.

Construction of Access Road and Well Pad

Access road and well pad construction would take two to three weeks at the proposed project site. The following equipment could be utilized onsite during construction of the proposed access road and well pad: chainsaw, brush hog, scraper, maintainer, excavator, and dozer.

Water diversions and silt traps (if needed) would be installed during interim reclamation; please see the "Design Features and Best Management Practices – Erosion Control," section above and the "Interim Reclamation" section, below. Additional sediment- and/or erosion-control features would be installed, as necessary. Additional resource-protection design features and mitigation associated with construction are listed above, in "Design Features and Best Management Practices."

<u>Proposed Well Pad</u>
The proposed well pad would be cleared of vegetation and leveled. Vegetation removed during construction, including trees that measure less than 3 inches in diameter (at ground level) and slash/brush, would be chipped, shredded, or mulched and incorporated into topsoil for later use in interim reclamation. When chipping slash and brush, the "chips" would be distributed in a manner that would not impede seeding with machinery or the establishment of successful revegetation. Trees 3 inches in diameter or greater (at ground level) would be cut to ground level and delimbed. Tree trunks (left whole) and cut limbs would be placed along the proposed access road, well pad, and well-connect pipeline corridor in a manner so as to not create additional disturbance or degrade new/existing reclamation, if present. The subsurface portion of the trees (tree stumps and root balls) would be hauled to an approved disposal facility or stockpiled at the edge of the well pad and buried in the cut slopes of the well pad during interim reclamation.

The top 6 inches of topsoil would be salvaged and stockpiled within the proposed well pad construction zones. The protection of topsoil is discussed in "Design Features and Best Management Practices – Protection of Topsoil," above.

The proposed well pad would measure 500 feet by 590 feet, including the 50-foot well pad construction zone around the perimeter of the pad. The maximum well pad cut would be 15.0 feet on the southeastern corner (corner 3). The maximum fill would be 12.8 feet on the northwestern corner (corner 6).

The proposed well pad would be constructed from the native borrow soil and subsoil accumulated during construction activities. The excavated material from well pad cuts would be used on the fill portions of the proposed well pad in order to create a level well pad surface. If additional fill or surfacing material would be needed, Encana would obtain the material from an existing permitted or private source and haul the material by truck utilizing existing access roads. The well pad construction zone could be limited in areas if specified by COAs attached to the approved APDs.

The size of the proposed well pad is slightly larger than a typical well pad in the BLM-FFO area because equipment (such as tanks) associated with the new hydraulic fracturing design requires a larger area.

Proposed Access Road

The proposed access road would be cleared of vegetation and leveled. Vegetation removal, topsoil removal, and access road construction would be similar to that described for well pads, above.

The top 6 inches of topsoil would be salvaged and stockpiled along the proposed access road. The protection of topsoil is discussed in “Design Features and Best Management Practices – Protection of Topsoil,” above.

The proposed access road would be 140 feet long. The maximum road grade would be 2-3 percent. The 30-foot-wide workspace associated with the proposed access road would include a 14-foot-wide running surface with adequate crowning. The proposed access road would be designed (e.g., drainage design, culvert sizing, and culvert installation) and constructed as a Resource Road in accordance with *The Gold Book* (BLM and USFS 2007) and BLM Manual 9113, Sections 1 and 2 (BLM 2011d and BLM 2011e). If the wells are commercially viable, Encana would upgrade the proposed access road, as necessary, to accommodate year-round traffic and meet all-weather standards. The proposed access road would be maintained for the life of the proposed project in accordance with *The Gold Book* (BLM and USFS 2007).

Drilling and Completion

Drilling

Once well pad and access road construction is completed, a drilling rig would be transported to the well pad and assembled. Drilling activities would take place around the clock for approximately two to three weeks per well; during this phase, there would be constant onsite supervision. During drilling, the following equipment would be on site: drilling rig, stockpiles of drill pipe and casing, closed-loop system for collection cuttings and fluid, above-ground tanks for collecting cuttings and fluid, mud shakers to separate cuttings from fluid, generators to provide power to the drill rig, light towers, toilet facilities, trash containers, and office trailers equipped with sleeping quarters for essential personnel.

Water for drilling would be obtained from an existing private water well located in the southwestern quarter of the northeastern quarter of Section 32, Township 25 North, Range 9 West (New Mexico Principal Meridian). The New Mexico Office of the State Engineer-assigned permit number for this water well is SJ-2105 (Blanco Trading Post). Water for drilling would be hauled by truck using existing and proposed access road.

The proposed project includes directional wells. The proposed wells would be targeting oil within the formations provided discussed in Section 1.1 (Background). The wells would be drilled from the proposed wellheads to the proposed bottom holes provided in Section 2.1.1 (Location of Proposed Project Area).

Utilizing a fresh water-based drilling mud system, the surface casings would be installed at an approximate depth of 500 feet. After a surface casing is installed, the casing would be cemented in place by pumping cement down the casing and circulating the cement back up the outside of the casing to create a cement sheath around the entire casing. The casing would then be tested to ensure the quality and integrity of the cement. The casing and cementing would stabilize the wellbore. In addition, the

casing and cementing would isolate hydrocarbon zones from overlying freshwater aquifers, thereby providing protection to any overlying freshwater aquifers.

Prior to drilling below the surface casing, a blowout preventer (BOP) would be installed on the surface casing. The BOP and surface casing would be pressure tested for integrity. After installation and testing of the BOP, a string of intermediate casing would be installed. The intermediate casing would then be cemented and tested to ensure the quality and integrity of the cement.

Once the intermediate string is cemented, a synthetic oil-based and/or freshwater-based drilling mud system would be used to drill the horizontal portion of the wellbore. A downhole mud motor would be used to increase the penetration rate during drilling. The drill rig would pump drilling fluids to drive the mud motor, cool the drill bit, and remove cuttings from the wellbore. Additives could be mixed with the mud system to achieve borehole stability, minimize potential damage to geologic formations, provide adequate viscosity to carry the drill cuttings out of the wellbore, and reduce downhole fluid losses.

After the wellbores have been drilled to their final depths, production liners would be installed and secured into place utilizing an external swell packer system. The production liners would provide additional isolation of the wellbores and create a pathway for oil and natural gas to travel from mineral formation to the surface.

Completion

After the production liners have been secured into place, the drilling rig would be removed from the proposed well pad, and a completion rig would be moved to the proposed well pad. Completion is the process in which a well is enabled to produce oil and natural gas. Completion typically takes one to two weeks for each well. During completion, the following equipment would be onsite: completions rig, completions command center, steel storage tanks, pump trucks and transports, blending and mixing facilities, and related ancillary completions equipment.

A completion rig would run a completion string into a wellbore for tying it into the liner/liner hanger. The completion string would be of the same size, weight, and grade as the production liner. The completions string tie in would provide a secondary barrier during completion operations for protecting the intermediate casing from pressures needed to pump into the formation.

Completion would require hydraulic fracturing, which is the process of injecting water, sand, and a small amount of fluid additives into the wellbore, under very high pressure, to fracture the targeted formations and release oil and natural gas. During this process, within the horizontal portion of the wellbores, a series of charges would be set through the producing interval to perforate the production liner and casing and create small fractures in the formation. A fluid and sand mixture would be injected into the formation, at high pressure, to create cracks or fractures. The sand would keep the fractures open and allow oil and natural gas to move more efficiently into the wellbore. The hydraulic fracturing process utilizes a series of plugs to isolate portions of a well that have been fractured. Once hydraulic fracturing has been completed, these plugs would be drilled out to allow the oil and natural gas to flow to a wellhead.

The completions would be designed with nitrogen foam for minimizing water usage and improving fluid recoveries following the completion phase. Water for completions would be obtained from the existing private water well (SJ-2105 [Blanco Trading Post]) described above and trucked to the locations. Water would be stored in steel storage tanks within the proposed project area. After the completion phase, a portion of the water injected for hydraulic fracturing would flow back to the wellheads and be collected in steel storage tanks stationed within the proposed project area. This flowback water would be disposed of at a State of New Mexico-permitted wastewater facility.

The final step of the completion phase would be the installation of tubing in the wellbores. This tubing would enhance production by creating a more efficient path for oil and natural gas to travel to the wellheads. At the wellheads, the flow of oil and natural gas would be regulated and controlled by a series of valves and instruments.

Construction of Well-Connect Pipeline Corridor

If the proposed wells prove to be productive, a well-connect pipeline would be constructed and installed to carry oil from the four proposed wells to Encana pipeline systems; the lifetime of a well-connect pipeline is anticipated to be 30 to 50 years. Pipeline construction would take three to four weeks for the proposed well-connect pipeline corridor.

The proposed well-connect pipeline would be up to a 6-inch-diameter steel pipe. Well-connect pipeline ROW corridors would be 40 feet in width. The length of the well-connect pipeline is 10,788 feet.

The maximum allowable operating pressure of the proposed well-connect pipeline would be 500 pounds per square inch gauge. Additional, related aboveground appurtenances (i.e., cathodic protection equipment, futures, and block valves with blowdowns) would be installed within the well-connect pipeline corridor. Equipment that would be subject to safety requirements would not be painted Covert Green.

For the proposed well-connect pipeline, site preparation would include clearing vegetation from the proposed corridor, salvaging and stockpiling topsoil, and excavating the pipe trench. The site preparation activities would be limited to the minimum area required for safe and efficient construction.

Vegetation clearing activities would be similar to those described in the “Proposed Project Phases - Construction of Access Road and Well Pad” section, above. Topsoil would be stockpiled along the edge of the proposed well-connect pipeline corridor. Trees cleared from the proposed corridor would be stacked along the proposed well-connect pipeline corridor and proposed access road; the tree limbs could also be stockpiled for use during interim reclamation. Tree stumps and root balls would be cut to ground level and would be buried within the corresponding proposed project area.

For the proposed pipe trench, the cover from the top of the pipe to ground level would be a minimum of 36 inches deep when located within typically encountered soil and rock and a minimum of 48 inches deep at road crossings. Where rock is encountered within the pipe trench, tractor-mounted mechanical rippers or rock trenching equipment could be used during trenching excavation activities.

Proposed well-connect pipeline construction and installation would include stringing the pipe, bending the pipe for horizontal or vertical angles in the pipeline alignment, welding pipeline segments together, inspecting the pipe, coating the pipe to prevent corrosion, and lowering the pipe into the trench. The pipe inspection would include the verification that the minimum pipe cover has been provided, the trench bottom is free of rocks/debris, the external pipe coating has not been damaged, and the pipe has been properly fitted and installed in the trench. The fine soil would be sifted from the subsoil stockpile in order to provide rock-free pipeline padding and bedding. In rocky areas, a padding material or rock shield would be used to protect the pipe. After a section of pipe has been lowered into the pipeline trench and inspected, the pipeline trench would be backfilled. Once the pipeline trench has been backfilled, cleanup activities would be initiated and interim reclamation would take place within the workspace, as described in the following section (Interim Reclamation) and within the proposed project reclamation plan (Appendix E).

Additional resource-protection design features and mitigation associated with construction are listed above, in “Design Features and Best Management Practices”.

Interim Reclamation

If the wells associated with the proposed project prove to be productive, portions of the proposed project area that would not be required for production (non-working areas [areas not necessary for the routine, long-term operation and maintenance of an authorized site]) would be reclaimed. Interim reclamation would be initiated within 120 days of construction. Interim reclamation would take two to four weeks for the proposed project’s well pad and access road. Interim reclamation would take one week for the proposed well-connect pipeline corridor. The BLM-FFO would be notified at least 48 hours prior to the start of interim reclamation activities at each location. Interim reclamation could occur simultaneously with production.

During interim reclamation, the following equipment could be utilized onsite: pick-up trucks, dozer, blade, farm tractor with a disc, trackhoe, and scraper.

Areas reclaimed during interim reclamation would include the project features described in Section 2.1.3 (Proposed Surface Disturbance), below. Approximately 11.0 acres of new surface disturbance would be reclaimed at this time.

In areas that would be reclaimed within the proposed project area, slopes would be re-contoured to pre-construction topographical contours, if possible. Encana would diminish the evidence of cuts, fills, and flat well pad surfaces.

Water- and erosion-control features would be installed within the proposed project area as described in "Design Features and Best Management Practices – Erosion Control." Additional water diversions, if needed, would be installed at this time.

Reclaimed areas would be seeded using the Sagebrush/Grass Community Seed Mixture.

The reclamation standards would comply with BLM-FFO Bare Soil Reclamation Procedure (BLM 2013b). Details of the interim reclamation process are provided in the reclamation plan (Appendix E).

Under the BLM-FFO Bare Soil Reclamation Procedures (BLM 2013b), Encana would monitor reclaimed surfaces to document successful interim reclamation; monitoring and reporting are discussed in the reclamation plan (Appendix E).

Production

The production phase of wells varies; the lifetime is anticipated to be 30 to 50 years. The installation of production equipment would take approximately three to four weeks at the project location. The proposed access road and the working areas of the proposed well pad would be maintained for the life of the proposed project.

Production equipment that would remain on the well pad during production would include the following: wellheads, metering units, separators, aboveground condensate tanks, water tanks (tank battery), meter(s), and VRU compressor(s). If artificial lift would be required, pump jack(s) and/or gas skid lift(s) would also be installed.

Tank batteries would be placed within corrugated steel secondary containment berms that would be sized to contain a minimum of 110 percent of the storage capacity of the largest tank within the bermed area. Containment berms would include an impermeable liner attached to the rings and laid under the tanks. All loading lines would also be placed inside the containment berms or would have secondary containment vessels.

At the proposed well sites, site security guidelines would be followed, as identified in 43 CFR 3162.7-5 and Onshore Oil and Gas Order No. 3. Production facilities would be painted Covert Green to blend with the natural environment. Equipment that would be subject to safety requirements would not be painted Covert Green. Production facilities would be placed, to the extent practical, to minimize visual impacts.

Occasionally, work-over or recompletion of the proposed wells would be necessary to ensure efficient production is maintained. Work-overs and recompletions would be scheduled as needed to improve and maintain production of the proposed wells. Work-over activities could include repairs to the wellbore equipment (e.g., casing, tubing, rods, pump), wellheads, or production facilities.

Final Reclamation and Abandonment

If the wells prove to be unproductive, or when the wells are no longer commercially viable, the wells would be abandoned and final reclamation would take place. The final abandonment phase typically takes two to four weeks.

During final reclamation, the following equipment could be utilized onsite: dozer, blade, farm tractor with a disc, trackhoe, and scraper.

Encana would provide the BLM-FFO with technical and environmental aspects of the final plugging, abandonment, and reclamation procedures.

Downhole well abandonment would be carried out under current BLM-FFO and State regulations. The bores would be plugged with cement and the production facilities would be removed. An aboveground marker would be placed over each plugged hole. Each marker would contain individual well identification information.

The underground well-connect pipeline would typically be plugged and left in place.

If the BLM-FFO considers the retention of the proposed well pad and access road, as well as existing access roads to the location, necessary for the management and multiple uses of natural resources, it/they would be reclaimed. The goal of final reclamation would be to return the disturbed areas associated with the proposed project to pre-construction conditions, if possible, by diminishing the evidence of cuts, fills, and flat well pad surfaces. Disturbed areas would be re-contoured to pre-construction topographical contours, covered with salvaged topsoil, and seeded. Erosion control measures, if needed, would be installed at this time.

Reclaimed areas would be seeded using the Sagebrush/Grass Community Seed Mixture.

Reclamation standards would comply with BLM-FFO Bare Soil Reclamation Procedure (BLM 2013b). Details of the interim reclamation process are provided in the reclamation plan (Appendix E).

Under the BLM-FFO Bare Soil Reclamation Procedures (BLM 2013b), Encana would monitor reclaimed surfaces to document successful interim reclamation; monitoring and reporting are discussed in the reclamation plan (Appendix E).

2.1.3. Proposed Surface Disturbance

The project would result in 13.7 acres of new surface disturbance. Of this, 0.1 acre would be reseeded (but not recontoured) and 10.9 acres would be fully reclaimed (reseeded and recontoured) during interim reclamation. The remainder (2.6 acres) would remain disturbed (unvegetated) throughout the life of the project. All portions of the project area that are not fully reclaimed during interim reclamation would be reclaimed when the wells are finally abandoned. Project features are summarized in the table below and described in detail in the sub-sections below.

Table 4. Surface Disturbance Associated with Proposed Project

Feature	Acreage		Description of New Disturbance Acreage Following Interim Reclamation		
	Total	New Disturbance	Fully Reclaimed (Reseeded and Recontoured)	Reseeded Only*	Unreclaimed*
Access Road	0.1	0.1	-	<0.1	<0.1
Pullout Areas (4)	0.3	0.3	-	0.1	0.2
Well Pad	4.5	4.5	2.1	-	2.4
Construction Zone	2.3	2.3	2.3	-	-
Well-Connect Pipeline Corridor	9.9	6.5	6.5	-	-
Total	**17.1**	**13.7**	**10.9**	**0.1**	**2.6**
*This acreage would be fully reclaimed during final reclamation.					

Access Road

The access road corridor would be 140 feet long and 30 feet wide (0.1 acre).

- The 14-foot-wide running surface of the road and the bottoms of the bar ditches alongside the road (less than 0.1 acre) would remain disturbed for the lifetime of the project. This acreage would be reclaimed during final reclamation.

- The remainder of the access road corridor (less than 0.1 acre) would be reseeded during interim reclamation and fully reclaimed during final reclamation.

Pullout Areas

The four proposed pullout areas would be 100 feet long, with 25 feet on each end (150 feet total; 0.3 acre) for entering and exiting the access road pullout areas. These pullout areas would be constructed along the upgraded road for the Piñon Unit M16 project. The pullout areas would be located at stationing 8+50 to 10+00, 29+00 to 30+50, 46+00 to 47+50, and 62+35 to 63+85.

- The four 10-foot-wide running surfaces of the access road pullout areas (0.1 acre) would remain disturbed for the lifetime of the project. This acreage would be reclaimed during final reclamation.

- The remainder of the access road pullout areas (0.2 acre) would be reseeded during interim reclamation and fully reclaimed during final reclamation.

Well Pad

The well pad would measure 400 by 490 feet (4.5 acres).

- The working area, which would measure 300 by 350 feet (2.4 acres), would remain disturbed until final reclamation, when the wells are abandoned.

- The remainder of the well pad (2.1 acres) would be fully reclaimed during interim reclamation.

Well Pad Construction Zone

A 50-foot-wide (2.3-acre) construction zone would surround the well pad. Less than 0.1 acre of the construction zone would overlap the Piñon Unit M16 access road. Therefore, the construction zone would result in 2.3 acres of new surface disturbance.

All new surface disturbance associated with the construction zone would be fully reclaimed during interim reclamation.

Well-Connect Pipeline Corridor

The well-connect pipeline corridor would be 10,788 feet long and 40 feet wide (9.9 acres). Portions of the well-connect pipeline corridor would overlap existing disturbance and disturbance associated with other areas of the Piñon Unit M16 project (described below). Therefore, new surface disturbance associated with the well-connect pipeline corridor would be 6.5 acres. All of this disturbance would be fully reclaimed during interim reclamation.

- Approximately 129 feet of the well-connect pipeline corridor length would travel parallel and adjacent to the Piñon Unit M16 access road. Approximately 15 feet of the well-connect pipeline corridor would overlap the Piñon Unit M16 access road. There would be 0.1 acre of new surface disturbance associated with this portion of the well-connect pipeline corridor.

- Approximately 8,465 feet of the well-connect pipeline corridor length would travel parallel and adjacent to existing and unnamed access roads to be upgraded with the Piñon Unit M16 project. Approximately 15 feet of the well-connect pipeline corridor would overlap the Piñon Unit M16

access road. There would be 4.9 acres of new surface disturbance associated with this portion of the well-connect pipeline corridor.

- Approximately 1,512 feet of the well-connect pipeline corridor length would travel parallel and adjacent to County Road 7515. Approximately 15 feet of the well-connect pipeline corridor would overlap the Piñon Unit M16 access road. There would be 0.9 acre of new surface disturbance associated with this portion of the well-connect pipeline corridor.

- Approximately 267 feet of the well-connect pipeline corridor length would travel parallel and adjacent to County Road 7610. Approximately 15 feet of the well-connect pipeline corridor would overlap the Piñon Unit M16 access road. There would be 0.2 acre of new surface disturbance associated with this portion of the well-connect pipeline corridor.

- Approximately 415 feet of the well-connect pipeline corridor length would travel cross country. There would be 0.4 acre of new surface disturbance associated with this portion of the well-connect pipeline corridor.

2.2. No Action

Under the No Action alternative, the APDs would not be approved. The proposed wells would not be drilled and the proposed well pad, access road, and well-connect pipeline would not be constructed. Current land and resource uses would continue to occur in the proposed project area.

2.3. Alternatives Considered but Eliminated from Detailed Study

Oil and natural gas wells can be drilled vertically or directionally/horizontally. Vertical drilling places a well pad directly above the bottom hole, while directional/horizontal drilling allows for flexibility in the placement of the well pad and associated surface facilities. Directional/horizontal drilling often allows for “twinning,” or drilling two or more wells from one shared well pad. Directional/horizontal drilling applications throughout the San Juan Basin have become relatively routine. Generally, the use of this technology is applied when it is necessary to avoid or minimize impacts to surface resources.

Factors such as reservoir depth, angle of deviation, lateral displacement, completion technique, and risk are considered before deciding on the use of directional drilling applications. In addition, operating factors such as production efficiency; rod, pump, and tubing wear; and workover frequency is also a consideration. Generally, directional well completion and operating costs are 20 to 25 percent higher than vertical well drilling costs. The primary economic factors that determine the feasibility of directional applications include, but are not limited to, incremental drilling, completion, and operating costs; oil and gas reserves; rates of production; oil and gas prices; royalties and taxes; and return on investment.

For the proposed well pad location, a *SHL [Surface Hole Location] Polygon & Feasibility Map* and SHL polygon shapefile were created for Encana’s ideal well(s) location footage(s). The *SHL Polygon & Feasibility Map* and SHL polygon shapefile were created to provide Encana, its surveyors, and its environmental consultants with information that was used in determining the best well pad location based on environmental considerations (topography, hydrology, wildlife habitats, etc.), technical limitations associated with horizontal drilling resource recovery considerations, and correlative rights issues. No alternative well pad locations were identified for the proposed project that would result in less surface disturbance than the proposed well pad location.

Utilizing the *SHL Polygon & Feasibility Map* and SHL polygon shapefile (depicted on Figure A.3 [Appendix A]), Encana was not able to place the proposed project within at their ideal well location (1,280 feet FSL and 330 feet FWL). However, the proposed project would remain within the preferred location and well within the Tolerable Well Placement Area.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Under the No Action alternative, current land and resource issues within the proposed project area would continue; there would be no new impacts from oil and gas development. The No Action alternative will serve as the baseline for comparing the environmental impacts of the analyzed alternatives, and will not be further evaluated in this EA (BLM 2008b).

3.1. Air Resources

3.1.1. Affected Environment

The proposed wells are located in San Juan County, New Mexico. Additional general information on air quality in the area is contained in Chapter 3 of the BLM-FFO PRMP/FEIS (BLM 2003a, 3-48 – 3-53). In addition, new information about greenhouse gases (GHGs), and their effects on national and global climate conditions has emerged since this document was prepared. On-going scientific research has identified the potential impacts of GHG emissions such as carbon dioxide (CO_2) methane (CH_4); nitrous oxide (N_2O); water vapor; and several trace gases on global climate. Through complex interactions on a global scale, GHG emissions may cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and burning of fossil carbon sources have caused GHG concentrations to increase measurably, and may contribute to overall climatic changes, typically referred to as global warming.

Much of the information referenced in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as Air Resources Technical Report; BLM 2014a). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

The EPA has the primary responsibility for regulating air quality, including six nationally regulated ambient air pollutants (criteria pollutants). These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and lead (Pb). EPA has established NAAQS for criteria air pollutants. The NAAQS are protective of human health and the environment. EPA has approved New Mexico's State Implementation Plan and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands and within Bernalillo County. Air quality is determined by atmospheric pollutants and chemistry, dispersion meteorology and terrain, and also includes applications of noise, smoke management, and visibility. Climate is the composite of generally prevailing weather conditions of a particular region throughout the year, averaged over a series of years. EPA has proposed or completed actions recently to implement CAA requirements for GHG emissions. Climate has the potential to influence renewable and non-renewable resource management.

Air Quality

Criteria Air Pollutants

The Air Resources Technical Report describes the types of data used for description of the existing conditions of criteria pollutants, how the criteria pollutants are related to the activities involved in oil and gas development, and provides a table of current National and state standards. EPA's Green Book web page (EPA 2013b) reports that all counties in the Farmington Field Office area are in attainment of all NAAQS as defined by the CAA. The area is also in attainment of all New Mexico Ambient Air Quality Standards (NMAAQS). The current status of criteria pollutant levels in the BLM-FFO are described below.

“Design Values” are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2012 design values for criteria pollutants are listed below in Table 5. There is no monitoring for CO and lead in San Juan County, but because the county is relatively rural, it is likely that these pollutants are not elevated. PM10 design concentrations are not available for San Juan County.

Table 5. 2012 Criteria Pollutant Monitored Values in San Juan County

Pollutant	2012 Design Concentration	Averaging Time	NAAQS	NMAAQS
O_3	0.071 ppm	8-hour	0.075 ppm[1]	
NO_2	13 ppb	Annual	53 ppb[2]	50 ppb
NO_2	38 ppb	1-hour	100 ppb[3]	
$PM_{2.5}$	4.7 µg/m^3	Annual	12 µg/m^3[3,4]	60 µg/m^3[3,6]
$PM_{2.5}$	14 µg/m^3	24 hour	35 µg/m^3[3,3]	150 µg/m^3[3,6]
SO_2	19 ppb	1-hour	75 ppb[5]	

Source:EPA 2014a
[1] Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
[2] Not to be exceeded during the year
[3] 98th percentile, averaged over 3 years
[4] Annual mean, averaged over 3 years
[5] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
[6] The NMAAQS is for Total Suspended Particulate (TSP)

In 2005, the EPA estimates that there was less than 0.01 ton per square mile of lead emitted in FFO counties, which is less than 2 tons total (EPA 2012). Lead emissions are not an issue in this area, and will not be discussed further.

Air quality in a given region can be measured by its Air Quality Index value. The air quality index (AQI) is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI<50), moderate (50-100), unhealthy for sensitive groups (100-150), unhealthy (>150), very unhealthy and hazardous. The AQI is a national index, the air quality rating and the associated level of health concern is the same everywhere in the country. The AQI is an important indicator for populations sensitive to air quality changes.

Mean AQI values for San Juan County were generally in the good range (AQI<50) in 2013 with 80% of the days in that range. The median AQI in 2013 was 42, which indicates “good” air quality. The maximum AQI in 2013 was 156, which is “unhealthy”.

Although the AQI in the region has reached the level considered unhealthy for sensitive groups on several days almost every year in the last decade, there are no patterns or trends to the occurrences as seen in the table below. On 8 days in the past decade, air quality has reached the level of “unhealthy” and on two days, air quality reached the level of “very unhealthy”. In 2009 and 2012, there were no days that were “unhealthy for sensitive groups” or worse in air quality. In 2005 and 2013, there was one day that was “unhealthy” during each year. In 2010, there were five “unhealthy” days and two “very unhealthy days”.

Table 6. Number of days classified as “unhealthy for sensitive groups” (AQI 101-150) or worse (EPA 2013a)

ear	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Days	3	6	9	18	1	0	12	9	0	1

Source: EPA 2013a

Hazardous Air Pollutants

The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (BLM 2014a). The EPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result

in high health risks and further emissions reduction strategies are necessary. A review of the results of the 2005 NATA shows that cancer, neurological and respiratory risks in San Juan County are generally lower than statewide and national levels as well as those for Bernalillo County where urban sources are concentrated in the Albuquerque area (EPA 2012).

Climate

The analysis area is located in a semiarid climate regime typified by dry windy conditions and limited rainfall. Summer maximum temperatures are generally in the range of 80 or 90 degrees Fahrenheit (°F), and winter minimum temperatures are generally in the teens to 20s. Temperatures occasionally reach above 100°F in June and July and have dipped below zero in December and January. Precipitation is divided between summer thunderstorms associated with the southwest monsoon and winter snowfall as Pacific weather systems drop south into New Mexico. The table below shows climate normals for the 30-year period from 1981 to 2010 for the Farmington, New Mexico, area.

Table 7. Climate Normals for the Farmington Area, 1981-2010

Month	Average Temperature (°F)	Average Maximum Temperature (°F)	Average Minimum Temperature (°F)	Average Precipitation (inches)
January	30.5	40.8	20.3	0.53
February	35.8	46.8	24.8	0.59
March	43.2	56.1	30.3	0.78
April	50.4	64.7	36.2	0.65
May	60.4	74.8	46.1	0.54
June	69.8	85.1	54.5	0.21
July	75.4	89.6	61.2	0.90
August	73.2	86.5	59.8	1.26
September	65.4	79.1	51.7	1.04
October	53.3	66.4	40.1	0.91
November	40.5	52.2	28.8	0.68
December	31.0	41.2	20.7	0.50
Source: data collected at New Mexico State Agricultural Science Center - Farmington				

Very recently, pioneering research using space-borne (satellite and aircraft) determination of methane concentrations have indicated anomalously large methane concentrations may occur in the Four Corners region (Kort et al. 2014). A subsequent study by Schneising et al. (2014) indicated larger anomalies over other oil and gas basins in the U.S. Methane is 34 times more potent at trapping GHG emissions than CO2 when considering a time horizon of 100 years (Intergovernmental Panel on Climate Change 2013). While space-borne studies can determine the pollutant concentration in a column of air, these studies cannot pinpoint the specific sources of air pollution. Further study is required to determine the sources responsible for methane concentrations in the Four Corners region; however, it is known that a significant amount of methane is emitted during oil and gas well completion (Howarth et al. 2011). Methane is also emitted from process equipment, such as pneumatic controllers and liquids unloading, at oil and gas production sites. Ground-based, direct source monitoring of pneumatic controllers conducted by the Center for Energy and Environmental Resources show that methane emissions from controllers exhibit a wide range of emissions and a small subset of pneumatic controllers emitted more methane than most (Allen et al. 2014a). Emissions measured in the study varied significantly by region of the U.S., the application of the controller and whether the controller was continuous or intermittently venting. The Center for Energy and Environmental Resources had similar findings of variability of methane emissions from liquid unloading (Allen et al. 2014b). In October 2012, EPA promulgated air quality regulations controlling volatile organic compound (VOC) emissions at gas wells. These rules require air pollution mitigation measures that reduce the emissions of VOCs. These same mitigation measures have a co-benefit of reducing methane emissions. Future ground-based and space-borne studies planned in the Four Corners region with emerging pollutant measurement technology may help to pinpoint significant, specific sources of methane emissions in the region.

The Air Resources Technical Report summarizes information about GHG greenhouse gas emissions from oil and gas development and their effects on national and global climate conditions. While it is difficult to determine the spatial and temporal variability and change of climatic conditions, increasing concentrations of GHGs are likely to accelerate the rate of climate change.

3.1.2. Impacts from the Proposed Action

Methodology and assumptions for calculating air pollutant and GHG emissions are described in the Air Resources Technical Report (BLM 2014a). This document incorporates the sections discussing the modification of calculators developed by the BLM to address emissions for one horizontal oil well. The calculators give an approximation of criteria pollutant, HAP, and GHG emissions to be compared to regional and national emissions levels. Also incorporated into this document are the sections describing the assumptions used in developing the inputs for the calculator (BLM 2014a).

Direct and Indirect Impacts

Criteria Pollutants

The table below shows estimated emissions from one proposed horizontal oil well for criteria pollutants, volatile organic compounds (VOCs), and GHGs. For comparison, Table 9 shows total human-caused emissions for each of the counties in the BLM-FFO and La Plata County, Colorado, based on the EPA's 2011 emissions inventory (EPA 2014b).

Table 8. Criteria Pollutant and VOC Emissions Estimated for Construction of One Horizontal Oil Well; Average 25 Days to Drill and Complete

Activity	NOx	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2	CH_4	CO_2
One time operations (tons)								
Construction	5.5	1.5	0.5	2.5	0.25	0.1	0.007	598.85
Completion	0.5	0.1	0.03	0.025	0.025	-	-	55.00
Interim Reclamation	0.006	0.006	0.006	0.001	-	0.003	-	1.24
Final Reclamation	0.006	0.006	0.006	0.001	-	0.004	-	1.66
Ancillary Operations (tons)								
Workover	0.129	0.04	0.01	0.01	0.01	-	-	10.59
Road Maintenance	-	-	-	-	-	-	-	0.26
Road Traffic	-	-	-	-	-	-	-	0.06
Annual operations (tons/yr)								
Oil Haul Truck and Small Truck (100 bbl/day)	0.009	0.006	0.0012	0.0009	0.0008	-	0.0001	3.88
Total	6.13	1.64	0.55	2.54	0.29	0.11	0.01	671.54

Oil storage tanks on the well location may result in venting of VOC. Oil well production is generally presented as barrels per day produced. The emissions calculator estimated that for every barrel per day produced there may be 0.12 tons of VOC vented per year.

The average horizontal oil well in the planning area produces approximately 100 barrels per day. One hundred barrels per day is estimated to result in 12 tons of VOC emissions per year. Oil storage tanks would be subject to current EPA regulations regarding the capture or flaring of VOC emissions.

Table 9. Analysis Area Emissions in Tons/Year, 2011

County	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2
McKinley	11,952.9	17,007.8	3,891.2	70,096.4	7,645.2	1,381.1
Rio Arriba	12,012.3	27,344.6	19,149.8	33,761.2	4,130.6	60.4
San Juan	42,231.5	63,568.9	26,110.8	76,638.3	9,201.0	5,559.3
Sandoval	4,143.8	19,513.9	4,373.1	39,343.0	4,510.8	109.3
La Plata	4,838.2	17,116.3	3,740.1	2,330.0	919.6	127.9
Total	**75,187.7**	**144,551.5**	**57,265.1**	**222,168.9**	**26,407.2**	**7,237.9**

Table 10 displays the percent increase in total emissions in the analysis area from the proposed action to construct and operate one horizontal oil well.

Table 10. Percent Increase in Analysis Area Emissions from the Proposed Action

	NO_X(1)	CO(2)	VOC(3)	PM_{10}(4,5)	$PM_{2.5}$(5,6)	SO_2(5,7)
Total Emissions	75,187.7	144,551.5	57,265.1	222,168.9	26,407.2	7,237.9
Conventional Gas Well Emissions	6.13	1.64	12.55(8)	2.54	0.29	0.11
Percent Increase	**0.008**	**0.001**	**0.02**	**0.001**	**0.001**	**0.002**

(1) NO_X – nitrogen oxides
(2) CO – carbon monoxide
(3) VOC – volatile organic compounds
(4) PM_{10} – particulate matter with an aerodynamic diameter equal to or less than 10 microns
(5) Values derived from average emissions for any well drilling in the analysis area. Calculated results available upon request.
(6) $PM_{2.5}$ – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
(7) SO_2 – sulfur dioxide
(8) Current EPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over six tons of VOC emissions per year

Hazardous Air Pollutants

The formulas used for calculating HAPs in the calculators are very imprecise. For many processes it is assumed that emission of HAPs will be equivalent to 10 percent of VOC emissions. Therefore, the estimated HAP emissions of 1.25 tons/year should be considered a very gross estimate. Most of the VOC emissions estimated for one horizontal oil well result from venting from oil storage tanks. Current EPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over 6 tons of VOC emissions per year. A reduction of 95% of oil storage tank VOC emissions would reduce the estimated HAP emissions to 0.12 tons/year.

Total Greenhouse Gases

The available statewide GHG summary combines GHG emissions from CO_2 and CH_4. To compare the GHG emissions from the Proposed Action estimated by the calculator with statewide GHG emissions, CO_2e emissions for both CH_4 and CO_2 were summed. The total statewide GHG emission estimate for 2007 was 76,200,000 metric tons CO_2e (76.2 million metric tons (NMED 2010). The estimated CO_2e metric tons emissions from one horizontal oil well (609.2 metric tons) would represent a 0.0008 percent increase in New Mexico CO_2 emissions.

Cumulative Impacts

The BLM-FFO manages Federal hydrocarbon resources in San Juan, Sandoval, Rio Arriba, and McKinley Counties. There are approximately 21,150 active oil and gas wells in the San Juan Basin. About 14,843 of the wells in these counties are Federal wells. Analysis of cumulative impacts for reasonable development scenarios and reasonably foreseeable development scenarios of oil and gas wells on public lands in the BLM-FFO was presented in the 2003 RMP. This included modeling of impacts on air quality. A more detailed discussion of cumulative effects can be found in the Air Resources Technical Report (BLM 2014a).

The primary activities that contribute to levels of air pollutant and GHG emissions in the Four Corners area are electricity generation stations, fossil fuel industries, and vehicle travel. The Air Quality Technical Report includes a description of the varied sources of national and regional emissions that are incorporated here to represent the past, present, and reasonably foreseeable impacts to air resources (BLM 2014a). It includes a summary of emissions on the national and regional scale by industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally), and transportation.

The emissions calculator estimated that there could be very small direct and indirect increases in several criteria pollutants, HAPs, and GHGs as a result of implementing the proposed alternative. The very small increase in emissions that could result would not be expected to result in exceeding the NAAQS for any criteria pollutants in the analysis area.

The very small increase in GHG emissions that could result from implementing the proposed alternative would not produce climate change impacts that differ from the No Action Alternative. This is because climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the action alternatives cannot be translated into effects on climate change globally or in the area of this site-specific action. It is currently not feasible to predict with certainty the net impacts from the action alternatives on global or regional climate.

The Air Resources Technical Report (BLM 2014a) discusses the relationship of past, present, and future predicted emissions to climate change and the limitations in predicting local and regional impacts related to emissions. It is currently not feasible to know with certainty the net impacts from particular emissions associated with activities on public lands.

3.2. Upland Vegetation

3.2.1. Affected Environment

The proposed project area is located within the Arizona/New Mexico Plateau ecological region. This ecological region occurs primarily in Arizona, Colorado, and New Mexico; a small portion of the region is located within Nevada. This region encompasses approximately 45,870,500 acres (185,632 square kilometers), and the elevation ranges from 2165 to 11,949 feet (660 to 3642 meters) AMSL. The ecological region's landscapes include low mountains, hills, mesas, foothills, irregular plains, alkaline basins, wetlands, and some sand dunes. The Arizona/New Mexico Plateau ecological region is a large transitional area located between semiarid grasslands to the east; drier shrublands and woodlands to the north; and lower, hotter, less-vegetated areas to the west and south. Vegetation communities within this region include shrublands of big sagebrush (*Artemisia tridentata*), rabbitbrush (*Ericameria* spp.), winterfat (*Krascheninnikovia lanata*), shadscale saltbush (*Atriplex confertifolia*), and greasewood (*Sarcobatus vermiculatus*); and grasslands of blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), and needle-and-thread grass (*Hesperostipa comata*). Higher elevations within the Arizona/New Mexico Plateau ecological region may support piñon pine (*Pinus edulis*) and juniper (*Juniperus* spp.) woodlands. This ecological region includes urban areas of Santa Fe and Albuquerque, New Mexico. Important land uses within the region include irrigated farming, recreation, rangeland, wildlife habitat, and some natural gas production (Griffith, et al. 2006).

The general region surrounding the proposed project area is characterized by rolling hills and shallow valleys vegetated with sagebrush shrublands and some open piñon-juniper woodlands. The terrain within the region follows a gentle slope to the northwest.

The proposed project area is primarily characterized by a sagebrush shrubland vegetation community. A badland vegetation community with open piñon-juniper woodlands is present within the northern section of the proposed project area. Elevation of the proposed project area ranges from approximately 6,720 feet to 6,930 feet AMSL. These vegetation communities are described below and in detail in the BSR (Appendix B).

Sagebrush Shrubland

Within the sagebrush shrubland vegetation community the dominant plant species were big sagebrush and blue grama. Vegetative cover is within the vegetation community is approximately 50 to 75 percent.

Badlands with Open Piñon-Juniper Woodlands

Within the badlands vegetation community, approximately 20 piñon pine and oneseed juniper (*Juniperus monosperma*) trees (85 percent mature, 10 percent juvenile, and 5 percent standing dead) are present. Ground cover within this vegetation community is approximately 20 to 30 percent.

3.2.2. Impacts from the Proposed Action

Direct and Indirect Impacts

During the construction phase of the proposed project, all vegetation within the 13.7 acres associated with the proposed project area would be cleared. During interim reclamation, approximately 11.0 acres of the proposed project area would be reclaimed. The remaining 2.6 acres would remain as compacted, barren surface for the life of the proposed wells. During final reclamation, Encana would reclaim all portions of the proposed project area that were not reclaimed during interim reclamation.

During interim and final reclamation, the BLM Sagebrush-Grass seed list would be utilized; the species included in this mixture are listed in the reclamation plan (Appendix E). Re-established vegetation would consist of native grass, forb, and shrub species included in the seed mixture, as well as native species that are not deliberately planted. It is also possible that invasive, non-native species could become established within the proposed project area, as such species could be transported by project equipment and tend to thrive in disturbed areas. Following the reclamation process, the resulting vegetation community could differ from the native plant community surrounding the proposed project area. Within reclaimed areas, it is not expected that the vegetation community would return to native conditions within 20 years (BLM 2003a, 4-18).

The deposition of fugitive dust generated during vegetation-clearing activities, during the use of the proposed well pad and access road, and during wind events could reduce photosynthesis and productivity of the surrounding vegetation (Thompson, et al. 1984; Hirano, et al. 1995), increase water loss in plants near the proposed project area (Eveling and Bataille 1984), and result in injury to leaves of surrounding vegetation.

Cumulative Impacts

The spatial analysis area includes the proposed project area and immediately adjacent lands.

The following vegetative disturbances have occurred within the spatial analysis area:

- There is an existing road at the start of the proposed access road
- Coleman Oil and Gas, Inc.'s (Coleman's) active Juniper 16 No. 14 well pad is located approximately 50 feet north of the proposed Piñon Unit M16 well-connect pipeline and road upgrade, and approximately 650 feet east of the proposed Piñon Unit M16 well pad.
- Coleman's active Juniper 16 No. 32 well pad is located approximately 600 feet west of the proposed Piñon Unit M16 well-connect pipeline and road upgrade.
- Coleman's active Juniper 16 No. 44 well pad is located approximately 800 feet east of the proposed Piñon Unit M16 well-connect pipeline and road upgrade.
- Coleman's active Juniper 9 No. 44 well pad is located approximately 50 feet east of the proposed Piñon Unit M16 well-connect pipeline.

- The proposed well-connect pipeline corridor parallels County Roads 7515 and 7610 as well as other unnamed roads.

- The proposed well-connect pipeline ends at Encana's existing Good Times L10-2410 well-connect pipeline.

- Active wildlife and livestock grazing occurs in the spatial analysis area. The spatial analysis area is within the Otis Community grazing allotment (Allotment No. 6011). The Otis Community allotment is permitted for year-round grazing by 1,178 sheep.

Indirectly, fugitive dust or deposition associated with existing and proposed roads and well pads in the immediate area could impact vegetation within the spatial analysis area, and could continue to do so throughout the life of the proposed project. The proposed project would contribute to direct vegetation disturbance and fugitive dust and/or deposition within the spatial analysis area.

3.3. Wildlife

3.3.1. Affected Environment

General Wildlife

The vegetation communities found within the proposed project area provide habitat for a variety of vertebrate and invertebrate species. The objectives of the BLM wildlife management program are to "ensure optimum populations and a natural abundance and diversity of fish and wildlife values by restoring, maintaining, and enhancing habitat conditions for consumptive and non-consumptive uses" (BLM 2003a, 2-24). The significance of the general region to the overall Lybrook/Upper Largo ecosystem is that it represents a metapopulation with respect to mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*).

No prairie dog colonies have been recorded by the BLM-FFO within or adjacent to the proposed project area (BLM 2012b); the closest recorded colony is approximately 6.7 miles north of the proposed project area. No sign of prairie dogs was observed during the biological survey.

General wildlife for the proposed project is described in detail in the BSR (Appendix B).

Migratory Birds

Executive Order (EO) 13186, dated January 17, 2001, calls for increased efforts to more fully implement the Migratory Bird Treaty Act of 1918. In keeping with this mandate, the BLM-FFO has issued an interim policy to minimize unintentional take, as defined by the EO, and to better optimize migratory bird efforts related to BLM-FFO activities. In keeping with this policy, a list of priority birds of conservation concern which occur in ecological regions similar to the proposed project area was compiled through a review of existing bird conservation plans, including the following:

- USFWS Birds of Conservation Concern
- New Mexico Partners in Flight New Mexico Bird Conservation Plan
- Comprehensive Wildlife Conservation Strategy for New Mexico
- Gray Vireo Recovery Plan
- The North American Waterbird Conservation Plan
- Recovery plans and conservation plans/strategies prepared for federally listed candidate species

The selected species have a known distribution in the BLM-FFO area and may be affected by various types of perturbations. These species and an evaluation of their potential to occur within the proposed project area are discussed in the BSR (Appendix B); a list of species identified within the proposed project area during the biological field survey is also provided.

3.3.2. Impacts from the Proposed Action

Direct and Indirect Impacts

There is available, similar habitat in the region surrounding the proposed project area that wildlife could utilize. However, the clearing of vegetation and the transformation of the proposed project area to a reseed community would remove potential habitat and result in habitat fragmentation for numerous wildlife species, including priority bird species.

During the construction phase of the proposed project, all vegetation within the 13.7 acres associated with the proposed project area would be cleared. Approximately 2.6 acres would remain barren of vegetation for the long term. Reclaimed portions of the proposed project area would be converted to a reseed community following interim reclamation and final reclamation. The impacts to the vegetation communities are described in detail in Section 3.3 (Upland Vegetation). If interim and final reclamation are successful, sagebrush shrublands and badlands with open piñon-juniper woodlands vegetation communities would become re-established within the proposed project area. However, as discussed in Section 3.3, the re-establishment of a mature, native plant community could require decades, and it is possible that the plant community could never fully recover from disturbance (BLM 2003a, 4-18).

Habitat loss and fragmentation likely reduce the carrying capacity for wildlife, although the exact level of reduction cannot be quantified (BLM 2003a, 4-26 – 4-27). Fragmentation would result from construction within areas that are not adjacent to existing surface disturbance. There would be approximately 11,518 linear feet (2.2 miles) of habitat fragmentation resulting from the proposed access road, well pad, and well-connect pipeline; this fragmentation would exist until final reclamation is deemed successful. Initial habitat fragmentation would result from proposed Piñon Unit M16 project features:

- Access road: 140 feet
- Well pad/construction zone: 590 feet (along longest side)
- Well-Connect Pipeline: 10,788 feet (The majority of this pipeline would parallel existing access roads/well-connect corridor)

For the long term, the proposed access road (including the road upgrade) and the working area of the proposed well pad (350 feet along the longest side) would result in 8,956 linear feet (1.7 mile) of long-term habitat fragmentation.

For the long term, occasional human and vehicle presence within the vicinity of the proposed project area would increase above present levels. Additional well equipment could also cause increased noise levels in the vicinity. Audial and visual disturbances associated with the proposed project could cause indirect habitat loss by deterring wildlife from using available habitat adjacent to the proposed project area.

General Wildlife

It is possible that burrowing animals could be killed or injured during the construction phase of the proposed project, as equipment digs into the earth and rolls over the surface of the ground.

During the construction phase of the proposed well-connect pipeline, terrestrial wildlife could fall into the open pipeline trenches and be injured, stressed, or killed. The presence of open trenches could also disrupt normal wildlife movements to and from water and/or food sources. Wildlife could have to skirt the open-trench portions of the proposed pipeline corridors to access water and/or food. This disruption could stress wildlife and result in the loss of valuable energy resources. As discussed in Section 2.1.2 (Description of Proposed Project – Protection of Flora and Fauna, Including SSS and Livestock), design features and BMPs would be implemented during the construction phase of the proposed well-connect pipeline to assist in the prevention of injury, stress, or death of wildlife.

Migratory Birds

Due to the mobility of adult birds, they would be unlikely to be directly harmed by the proposed project. If the vegetation-clearing phase of construction for the proposed project is scheduled to occur during migratory bird breeding season, a pre-construction nest survey would take place, as discussed in Section 2.1.2 (Description of Proposed Project – Protection of Flora and Fauna, Including SSS and Livestock). Therefore, it is unlikely that any nests, eggs, or young birds would be directly harmed by the proposed project. Birds nesting outside of but near the proposed project area could abandon existing nests as a result of visual and audial disturbances.

It is difficult to predict the effects of the proposed project on migratory birds. The increased activity, noise, and disturbed vegetation associated with the proposed project could result in the increased usage of the immediate area by some migratory bird species, while decreasing usage by other species. Studies have shown mixed impacts of oil and gas development on nesting migratory birds. According to a study by Ortega and Francis (2007), the presence of oil and gas compressors affected bird species differently; however, there was no difference in overall nest density on plots with and without compressors. A study by Holmes and King (2006) found that the sage sparrow had lower nest survival in an area with ongoing gas development; however, the Brewer's sparrow had higher nest survival rates in a developed gas field when compared with populations in an undeveloped control area.

Cumulative Impacts

The spatial analysis area for wildlife includes the proposed project area and an approximately two-mile radius surrounding the proposed project area. Within the spatial analysis area, there is existing and proposed disturbance, and the region has been fragmented. Existing and reasonably foreseeable future disturbance within the spatial analysis area includes the following:

- 84 new or active oil and/or gas wells and associated well pads
- 32 inactive oil and/or gas wells and associated well pads (some reclaimed)
- 4 proposed oil and/or gas well pads and associated roads and utility corridors
- Approximately 40 miles of existing roads (including approximately 15 miles of County Roads)
- Numerous existing and proposed utility ROWs
- Active wildlife and livestock grazing; the spatial analysis area is within The Otis Community (Allotment No. 6011). The Otis Community allotment is described in Section 3.3.2 (Upland Vegetation – Impacts from the Proposed Action – Cumulative Impacts).

Habitat disturbance and fragmentation in the spatial analysis area is primarily the result of oil and gas development (including well pads, access roads, and pipeline corridors). The direct and indirect habitat disturbance, fragmentation, and human activities associated with these disturbances could deter wildlife from utilizing portions of the spatial analysis area. The proposed action would contribute to direct and indirect habitat disturbance and fragmentation in the spatial analysis area.

3.4. Special Status Species

3.4.1. Affected Environment

The BLM manages certain species which are not federally listed as threatened or endangered in order to prevent or reduce the need to list them as threatened or endangered in the future. BLM SSS include BLM Sensitive Species and BLM-FFO Special Management Species (SMS).

New Mexico BLM State Directors have developed a list of BLM Sensitive Species for the State of New Mexico (BLM 2011a, BLM 2011b, BLM 2011c, BLM 2012a). In accordance with BLM Manual 6840, the BLM-FFO has prepared a list of BLM-FFO SMS to focus species management efforts toward maintaining

habitats under a multiple-use mandate (BLM 2008a, BLM 2008c). BLM-FFO SMS include some BLM Sensitive Species and other species for which the BLM-FFO has determined special management is appropriate (BLM 2008c). The authority for this policy and guidance is established by the ESA; Title II of the Sikes Act, as amended (16 USC 670a-670o, 74 Stat. 1052); FLPMA; and Department of Interior Manual 235.1.1A.

Based on known range and habitat, six BLM SSS have the potential to occur within the proposed project area. These species and their habitat requirements are discussed in detail in the BSR (Appendix B). Potential SSS habitat is similar within the proposed project area. The SSS with the potential to occur within the proposed project area are as follows:

- Aztec gilia (BLM Sensitive and SMS): within BLM-FFO-designated potential habitat "zone" (BLM 2013a). No individuals identified during transect surveys of proposed project area.
- Brack's fishhook cactus (BLM Sensitive and SMS): within BLM-FFO-designated potential habitat "zone" (BLM 2013a). One individual was identified along the proposed well-connect pipeline corridor during transect surveys of the proposed project area.
- Bendire's thrasher (BLM Sensitive): potential foraging and nesting habitat available.
- Ferruginous hawk (BLM Sensitive and SMS): potential foraging habitat available.
- Golden eagle (BLM SMS): potential foraging habitat available.
- Pinyon jay (BLM Sensitive): potential foraging and nesting habitat available.

3.4.2. Impacts from the Proposed Action

Direct and Indirect Impacts

Aztec Gilia and Brack's Fishhook Cactus

The proposed project would result in the disturbance of up to 13.7 acres of Aztec gilia/Brack's fishhook cactus habitat. Of this, 2.6 acres would remain unvegetated and in use by project personnel throughout the lifetime of the proposed project. Approximately 0.1 acre would be reseeded during interim reclamation. The remaining 10.9 acres would be fully reclaimed during interim reclamation. The reseeded and fully reclaimed acreage could become populated by Aztec gilia and Brack's fishhook cacti in the future, although the likelihood of these species becoming reestablished in a recently disturbed area is unlikely.

During final reclamation, Encana would reclaim all portions of the proposed project area that were not fully reclaimed during interim reclamation. This would include clearing the vegetation from within the 0.1-acre portion of the proposed access road corridor and pullout areas that were only reseeded (not recontoured) during interim reclamation. It is possible that if Aztec gilia and/or Brack's fishhook cacti become established within reseed-only areas following interim reclamation, they could be killed during the clearing-and-recontouring phase of final reclamation.

<u>Aztec Gilia</u>
As no Aztec gilia were identified during the biological survey, no direct impacts to individuals are anticipated as a result of the proposed project. However, it is possible that Aztec gilia individuals could have been overlooked during the biological survey and could be destroyed by the proposed project.

<u>Brack's Fishhook Cactus</u>
Under BLM guidance (BLM 2014b), no transplanting is required for proposed projects with less than 30 Brack's fishhook cacti. Therefore, the one individual cactus identified within the proposed project area would be killed as a result of the proposed project. It is possible that additional Brack's fishhook cacti could have been overlooked during the biological survey and could be destroyed.

Bendire's Thrasher and Pinyon Jay

Impacts to Bendire's thrashers would be similar to those described for migratory birds (Section 3.4.2 [Wildlife– Impacts from the Proposed Action – Migratory Birds]).

Ferruginous Hawk and Golden Eagle

Due to the mobility of adult raptors and the lack of appropriate nesting sites for these raptors in the vicinity of the proposed project area, it is unlikely that these raptors would be directly harmed by activities associated with the proposed project.

The clearing of vegetation would result in the removal of foraging habitat and the creation of habitat fragmentation for raptors. In addition, audial and visual disturbances associated with the proposed project could cause indirect habitat loss. Habitat loss and fragmentation are described in detail in Section 3.4.2 (Wildlife – Impacts from the Proposed Action - Direct and Indirect Impacts).

Cumulative Impacts

The spatial analysis area for SSS includes the proposed project area and an approximately two-mile radius around the proposed project area. Within the spatial analysis area, there is existing disturbance and reasonably foreseeable future disturbance is anticipated. This disturbance is described in detail in Section 3.4.2 (Wildlife – Impacts from the Proposed Action – Cumulative Impacts). Habitat disturbance in the area is primarily the result of oil and gas development (including well pads, access roads, and pipeline corridors).

Cumulative impacts to these SSS would be similar to those described for wildlife (Section 3.4.2 [Wildlife - Impacts from the Proposed Action – Cumulative Impacts]).

3.5. Cultural Resources

3.5.1. Affected Environment

The proposed project area is located within the archaeologically rich San Juan Basin of northwestern New Mexico. In general, the history of the San Juan Basin can be divided into five major periods: PaleoIndian (circa [ca.] 10000 B.C. to 5500 B.C.); Archaic (ca. 5500 B.C. to A.D. 400); Basketmaker II-III and Pueblo I-IV (aka Anasazi; A.D. 1-1540); and historic (A.D. 1540 to present), which includes Native American as well as later Hispanic and Euro-American settlers. Detailed descriptions of these various periods are provided in the BLM-FFO PRMP/FEIS (BLM 2003a, pp. 3-65 – 3-84) and will not be reiterated here. Additional information can also be found in an associated documented, the Cultural Resources Technical Report (Science Applications International Corporation 2002).

Cultural sites vary considerably, and can include but are not limited to simple artifact scatters, domiciles of various types with a myriad of associated features, rock art and inscriptions, ceremonial/religious features, and roads and trails.

The entire Area of Potential Effect (APE) for the proposed action was archaeologically surveyed by LAC at a BLM Class III (100-percent) level. The archaeological report (LAC Report No. 2012-1LLL [2015], BLM Report No. 2015(II)011F) was prepared and submitted to the BLM in accordance with the *Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities* (BLM 2005). The Class III inventory resulted in the identification of two previously recorded cultural sites within the APE. Both sites contain at least one component that may be potentially eligible for inclusion in the NRHP (LAC 2015). No TCPs are known to exist in the APE.

3.5.2. Impacts from the Proposed Action

Direct and Indirect Impacts

Direct impacts normally include alterations to the physical integrity of a cultural site. If a cultural site is significant for other than its scientific information, direct impacts may also include the introduction of audible, atmospheric, or visual elements that are out of character for the cultural site. A potential indirect impact from the proposed action is the increase in human activity or access to the area with the increased potential of unauthorized removal of or other alteration to cultural sites in the area.

Significant cultural sites (e.g., sites eligible for the NRHP) would be avoided with the implementation of design features such as, but not limited to, reduction of construction areas, installation of temporary barriers, and site monitoring. These design features are detailed in the Cultural Resource Record of Review, attached to the COAs in the approved APDs. The proposed action would not be expected to physically threaten any TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere with or otherwise hinder the performance of traditional ceremonies/rituals pursuant to the AIRFA (42 USC 1996), EO 13007, or the NAGPRA (25 USC 3001). The proposed action would have no direct or indirect impact on significant cultural sites.

Cumulative Impacts

There would be no negative cumulative impacts on cultural resources as significant cultural sites would be avoided. A positive cumulative effect is the additional scientific information yielded by the archaeological survey.

3.6. Livestock Grazing

3.6.1. Affected Environment

The proposed project area is located entirely within a single grazing allotment (Otis Community Allotment No. 6011). The vegetation communities within the allotment include sagebrush shrublands and badlands with open piñon-juniper woodlands. The term grazing authorization permits the utilization of 2,827 active AUMs of forage for sheep. The allotment is 31,936 acres and is a BIA-managed allotment. Average rangeland carrying capacity for the allotment is 11.3 acres per AUM for sheep.

An existing fence line is present within the proposed project area.

3.6.2. Impacts from the Proposed Action

Direct and Indirect Impacts

The proposed project would result in the surface disturbance of 13.7 acres within the Otis Community allotment. The estimated short-term impact to range carrying capacity would be a loss of 1.0 AUM (assuming an average rangeland carrying capacity of 11.3 acres per AUM and a disturbance area of 10.9 acres). After successful interim reclamation, the long-term-loss would be 0.2 AUM (assuming an average rangeland carrying capacity of 11.3 acres per AUM and a long-term working area of 2.6 acres).

Additional short-term impacts could include displacement of permitted livestock during construction activities or exposure of livestock to hazards. After construction, livestock should become acclimated to the wells and traffic associated with their maintenance. Vehicle traffic associated with the wells could pose impacts to livestock, considering that the area is open range and livestock may be found on roads in the area.

Direct impacts to livestock could occur if holes or ditches are not excluded properly. Any type of hole or ditch is potentially a hazard to livestock while grazing. Cow or calf injuries could occur if these animals fall into or try to get out of a ditch-type cavity. Cow or calf leg injuries could also occur if a small hole is left uncovered. Livestock could step into the hole and break a leg. Mitigation associated with the protection of livestock during pipeline trenching is discussed in detail in Section 2.1.2 (Description of Proposed Project

– Design Features and Best Management Practices - Protection of Flora and Fauna, including SSS and Livestock).

As discussed in Section 2.1.2 (Description of Proposed Project – Protection of Flora and Fauna, Including SSS and Livestock), an existing fence line located within the proposed well pad would be braced, cut, and permanently re-routed around the proposed well pad construction zone. During interim reclamation, the fence line would be re-built following *The Gold Book* (BLM and USFS 2007).

Cumulative Impacts

The spatial analysis area for livestock is the Otis Community allotment. Within this allotment, the following existing and reasonably foreseeable disturbances are present:

- Several existing utility corridors
- 231 active oil and/or gas wells and associated well pads
- 26 inactive oil and/or gas wells and associated well pads (some reclaimed)
- 5 proposed oil and/or gas wells and associated well pads, roads, and utility corridors
- 76 miles of roads

The proposed project would contribute to cumulative disturbance within this allotment.

3.7. Environmental Justice

3.7.1. Affected Environment

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, requires that Federal agencies identify and address any disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations.

Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies. It focuses on environmental hazards and human health to avoid disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Guidance on environmental justice terminology developed by the President's Council on Environmental Quality (CEQ 1997) is discussed below.

- Low-income population. A low-income population is determined based on annual statistical poverty thresholds developed by the US Census Bureau. In 2012, poverty level is based on total income of $11,720 for an individual and $23,283 for a family of four (US Census Bureau 2012a). A low-income community may include either a group of individuals living in geographic proximity to one another or dispersed individuals, such as migrant workers or Native Americans.
- Minority. Minorities are individuals who are members of the following population groups: American Indian, Alaskan Native, Asian, Pacific Islander, Black, or Hispanic.
- Minority population area. A minority population area is so defined if either the aggregate population of all minority groups combined exceeds 50 percent of the total population in the area or if the percentage of the population in the area comprising all minority groups is meaningfully greater than the minority population percentage in the broader region. Like a low-income population, a minority population may include either individuals living in geographic proximity to one another or dispersed individuals.

- Comparison population. For the purpose of identifying a minority population or a low-income population concentration, the comparison population used in this study is the state of New Mexico as a whole.

Low-income Populations

Income and poverty data estimates for study area counties from the US Census Small Area Poverty Estimates model indicate that the percent of the population living below the poverty level in the socioeconomic study area as a whole is slightly above that of the state (21.3 percent and 20.6 percent), but it is much higher than the national average of 15.9percent (Table 11). Poverty levels ranged from 37.7 percent in McKinley County to 13.7 percent in San Juan County. Only that of Sandoval County was below the state average.

Table 11. Study Area County Population in Poverty (2002-2012)

	McKinley County	Rio Arriba County	Sandoval County	San Juan County	Study Area Total	New Mexico	United States
Percent of Population in Poverty 2002	21,766	7,165	19,934	22,152	71,017	421,123	34,569,951
	30.2%	17.7%	11.1%	18.2%	21.3%	20.6%	12.1%
Percent of Population in Poverty 2012	27,296	8,806	18,502	25,802	80,406	327,444	48,760,123
	37.7%	22.0%	13.7%	20.3%	21.5%	17.7%	15.9%
Median Household Income 2002	$25,197	$30,557	$45,213	$34,329	N/A	$34,827	$45,409
Median Household Income 2012	$29,821	$36,900	$57,376	$45,901	N/ A	$42,828	$51,371
Classified as Low Income Population in 2012 based on CEQ guidelines?	No	No	No	No	No	NA	NA

Source: US Census Bureau 2013

Similarly, estimates from 2012 indicate that Sandoval and San Juan Counties had household median incomes ($57,376 and $45,901) that were above the state level of $42,828. McKinley County ($29,821) and Rio Arriba County ($36,900) were below that of the state in 2012 (Table 12). While no area communities meet the CEQ definition of a low-income population area (50 percent or higher), the highest poverty rates were seen in Bloomfield (29 percent), Espanola (26.3 percent), and Bernalillo (24.1 percent).

Table 12. Study Area Key Community Race/Ethnicity and Poverty Data

Community	% Population Racial or Ethnic Minority	Classified as Minority Population based on CEQ?	% of Individuals Below Poverty	Classified as Low-income Population based on CEQ?
Aztec	36.4%	No	14.4%	No
Bernalillo	78.8%	Yes	24.1%	No
Bloomfield	55.8%	Yes	29.0%	No
Espanola	91.6%	Yes	26.3%	No
Farmington	48.8%	No	15.5%	No
Gallup	76.9%	Yes	20.9%	No
Rio Rancho	46.7%	No	9.8%	No

Source: US Census Bureau 2012b
Note: American Community Survey estimates are based on data collected over a 5-year time period. The estimates represent the average characteristics of populations between January 2008 and December 2012 and do not represent a single point in time.

Census Tracts are geographic regions within the United States that are defined by the US Census Bureau in order to track changes in a population over time. Census Tracts are based on population sizes and not geographic areas. The average population of a Census Tracts is about 4,000 people, so rural

areas that are sparsely populated may have very large Census Tracts while densely populated urban areas may have very small Census Tracts.

When broken down by Census Tract, 3 out of 87 tracts in the socioeconomic study area have greater than 50 percent of individuals living below the poverty line: Census Track 9440 in eastern McKinley County had an individual poverty rate of 54.6 percent; Census Tract 9405 in southwestern McKinley County had an individual poverty rate of 59.4 percent; and Census Tract 9409 in northwestern Sandoval County had an individual poverty rate of 51.9 percent (US Census Bureau 2012b). These 3 Census Tracts are all relatively large, indicating a sparsely populated, rural area.

Minority Populations

Based on 2008-2012 data, minorities made up 59.5 percent of the population in New Mexico, compared to 36.3 percent in the United States as a whole (Table 13). The proportion of minorities in the socioeconomic study area (65.3 percent) substantially exceeded the United States and is slightly higher than the state average. At the county level, the population ranged from 89.7 percent minority in McKinley County to 52.8 percent in Sandoval County. Within relevant tribal nations, Native Americans represented the vast majority of the population. The largest minority groups were Hispanics/Latinos in Rio Arriba and Sandoval Counties and Native Americans in McKinley and San Juan Counties.

Table 13. Study Area County Population by Race/Ethnicity (2008-2012)

Population	McKinley County	Rio Arriba County	Sandoval	San Juan	Study Area	New Mexico	United States	Jicarilla Apache Nation	Navaho Nation	Ute Mountain Nation
Hispanic or Latino ethnicity of any race	9,744	28,714	46,334	24,496	109,288	952,569	50,545,275	382	2,958	99
	13.6%	71.4%	35.3%	19%	29%	46.3%	16.4%	11.6%	1.7%	6.0%
White alone	7,413	5,370	61,977	54,218	128,978	831,543	196,903,968	74	3,762	47
	10.3%	28.6%	47.2%	42.2%	34.67%	40.5%	63.7%	2.3%	2.2%	2.9%
Black or African American alone	353	149	2,704	794	4000	35,586	37,786,591	0	250	5
	0.5%	0.4%	2.1%	0.6%	1.08%	1.7%	12.2%	0%	0.1%	0.3%
American Indian or Alaskan Native alone	52,358	5,629	15,964	46,676	120,627	176,766	2,050,766	2,692	162,920	1,429
	72.8%	14.0%	12.2%	36.3%	32.43%	8.6%	0.7%	82.0%	94.3%	87.0%
Asian alone	506	173	1,685	464	2828	25,411	14,692,794	73	834	14
	0.7%	0.4%	1.3%	0.4%	0.76%	1.2%	4.8%	2.2%	0.5%	0.9%
Native Hawaiian and Other Pacific Islander alone	38	7	100	72	217	989	480,063	0	209	0
	0.1%	0%	0.1%	0.1%	0.06%	<.01%	0.2%	0%	0.1%	0%
Some Other Race	7	22	437	84	550	3,623	616,191	0	102	0
	<.01%	0.1%	0.3%	0.1%	0.15%	0.2%	0.2%	0%	0.1%	0%
Two or more Races	1,469	137	2,101	1,796	5,503	28,800	6,063,063	62	1,660	49
	2.0%	0.3%	1.6%	1.4%	1.48%	1.4%	2.0%	1.9%	1.0%	3.0%
Classified as Minority Population based on	Yes	Yes	Yes	Yes		Yes	NA	Yes	Yes	Yes

Table 13. Study Area County Population by Race/Ethnicity (2008-2012)

Population	McKinley County	Rio Arriba County	Sandoval	San Juan	Study Area	New Mexico	United States	Jicarilla Apache Nation	Navaho Nation	Ute Mountain Nation
CEQ guidelines?										
Source: US Census Bureau 2012b Note: American Community Survey estimates are based on data collected over a 5-year time period. The estimates represent the average characteristics of populations between January 2008 and December 2012 and do not represent a single point in time										

Based on the CEQ definition of a minority population area (minority residents exceed 50 percent of all residents), Bernalillo, Bloomfield, Espanola, and Gallup all are considered minority communities.

When examined at the Census Tract level, there are 24 out of 87 tracts that have a minority population greater than 50 percent. These range from Census Tract 6.1 located just north of the city of Aztec with a minority population of 80.5 percent to Census Tract 107.17 located north of the city of Rio Rancho with a minority population of 50.2 percent (US Census Bureau 2012b). These Census Tracts are relatively small and are based around the city of Rio Rancho and the Aztec/Farmington/Bloomfield area.

Native American Populations

Data in Table 13 account for a substantial portion of the study area population in some areas, notably McKinley and San Juan Counties, where the population is 72.8 and 36.3 percent American Indian respectively. Three tribal governments have reservations within the planning area: the Jicarilla Apache Nation, the Navajo Nation, and the Ute Mountain Nation (Table 14). The Southern Ute Nation has lands just north of the planning area in the state of Colorado, but none within the planning area. Almost one half of the planning area is tribal lands. Each tribe maintains a general concern for protection of and access to areas of traditional and religious importance, and the welfare of plants, animals, air, landforms, and water on reservation and public lands. Policies established in 2006 by the BLM and US Forest Service, in coordination with Federal tribes, ensure access by traditional native practitioners to area plants. The policy also ensures that management of these plants promotes ecosystem health for public lands. The BLM is encouraged to support and incorporate into their planning traditional native and native practitioner plant-gathering for traditional use (Boshell 2010).

Table 14. Tribal Nations in the Planning Area

Tribe	Acres in Planning Area	General Location
Jicarilla Apache Nation	739,600	The majority of the Jicarilla Apache Nation is located in western Rio Arriba County, but within the eastern portion of the planning area
Navajo Nation	860,900	A portion of the Navaho Nation extends into western San Juan County and into the western portion of the planning area
Ute Mountain Nation	103,500	A portion of the Ute Mountain Nation extends into the northern portion of San Juan County, just east of the Navajo Nation, and into the northern portion of the planning area
Unknown	196,300	Lands located in the southern portion of the planning area [Note to BLM: this is due to inconsistencies between US Census Bureau tribal areas dataset and BLM land status dataset.]
Source: US Census Bureau 2014		

3.7.2. Impacts from the Proposed Action

Direct and Indirect Impacts

The proposed project would result in no disproportionate, negative effects to minority or low-income populations. The proposed project would not negatively affect socioeconomics in the region.

There are a few scattered homes located on tribal surface within a one-mile radius of the proposed project area. However, no negative, direct effects to individuals, groups, or communities would be expected.

Indirectly, there could be positive, short- and/or long-term effects to socioeconomics associated with the proposed project. The proposed project could contribute to employment opportunities in the oil and gas industry. In addition, there could be taxes and royalties to state and county governments as a result of the proposed project.

Cumulative Impacts

The spatial analysis area for the proposed project is the BLM-FFO planning area. In the BLM-FFO planning area, the oil and gas industry is the dominant force in the economy. In New Mexico, the oil and gas industry provides nearly one billion dollars per year in taxes, royalties, and interest to the State; at least half of this is related to oil and gas production in the San Juan Basin. This industry is a primary employer and provides higher paying jobs than many other job sectors available to the population. As of 2000, over 11,000 people in northwestern New Mexico were employed in the industry. Overall, the positive effects of oil and gas development in the spatial analysis area are expected to outweigh any changes in jobs, expenditures, or revenues resulting from any other actions expected or likely in the region (BLM 2003a, 3-100). The proposed project would contribute to this positive cumulative impact.

3.8. Public Health and Safety

3.9.1. Affected Environment

Worker safety is regulated under the Occupational Safety and Health Act of 1970, as amended (29 USC 651). Additional safety regulations found in Pipeline Safety Programs and Rulemaking Procedures (49 CFR 190) and Transportation of Natural and Other Gas by Pipeline: Minimal Federal Safety Standards (40 CFR 192) apply to natural gas pipelines.

The proposed project area is fairly remote. The nearest town, Blanco (population 388 [U.S. Census Bureau 2010]), is approximately 5 miles to the northeast. New Mexico Highway 57 is located approximately 2 miles to the east. There are no designated recreation areas or commercial areas within one mile of the proposed project area. However, a few scattered residences are located on tribal surface within the area; the location is accessible to the public by dirt road.

The nearest hospital is in Farmington, New Mexico. This hospital is approximately 33 air miles or approximately 59 road miles (5 miles of dirt road and 44 miles of paved road) from the proposed well pad.

3.8.2. Impacts from Proposed Action

Direct and Indirect Impacts

As a result of the proposed project, short-term effects to public health and safety would be low to moderate. For the long term, effects to public health and safety would be low.

The proposed project would affect transportation. During construction, the proposed project would result in increased traffic on area roads; some vehicles would be hauling heavy equipment. Therefore, there would be an increased potential for traffic accidents. Dust associated with construction activities or travel on dirt access roads may result in poor visibility in the area. The increased use of dirt access roads during muddy conditions may worsen the roads' conditions. The upgrade of the existing access road would be an improvement to safety conditions. Following construction, traffic levels would be similar to current levels; long-term effects on transportation would be low.

During construction, drilling, and maintenance activities, the operation of heavy equipment poses potential safety concerns. Existing facilities (such as oil and gas wells, pipelines, and powerlines) could be damaged or ruptured, posing a risk to human safety.

During the operation of the proposed well, facility failure (such as well-connect pipeline ruptures) could represent a potential danger to the public.

Hazardous and solid wastes associated with the proposed project are discussed in Section 2.1.2 (Description of Proposed Project – Design Features and Best Management Practices – Control of Waste). As a result of the proposed project, the public could be exposed to hazardous materials.

Cumulative Impacts

The general BLM-FFO region has been developed by the oil and gas industry for over six decades, which contributes to public health and safety concerns in the area.

Transportation issues are a primary safety concern. Vehicles associated with the oil and gas industry utilize the developed highway and county road systems. In addition, the oil and gas industry constructs and utilizes dirt access roads in the area. These roads, most of which are accessible by the public, are often hazardous, particularly during and following periods of inclement weather.

Additional safety concerns in the region include wildfire; oil and gas facility leakage or rupture; moving equipment (such as pump jacks); oil and gas explosions; and the handling, storage, and disposal of wastes, chemicals, or condensate. Hazardous and solid wastes are discussed in Section 2.1.2 (Description of Proposed Project – Design Features and Best Management Practices).

The proposed project would contribute minimally to the cumulative public safety impacts in the region.

4. SUPPORTING INFORMATION

4.1. Tribes, Individuals, Organizations, or Agencies Consulted

The following tribes, individuals, organizations, and/or agencies were consulted during the development of this EA:

- Huerfano Chapter House

The BLM ensures its responsibilities under the National Historic Preservation Act (NHPA) through a number of agreements. The national Programmatic Agreement (nPA) between the BLM, Advisory Council on Historic Preservation (ACHP), and the National Council of State Historic Preservation Officers (NCSHPO) ensures that, across the agency, the cultural resource programs operate according to the regulations set forth in Section 106 of the NHPA. The BLM's national Programmatic Agreement, which applies to all BLM activities below specified thresholds, provides regulatory relief in most instances from the requirement for case-by-case review by State Historic Preservation Officers (SHPOs) and the ACHP, in exchange for managers' maintenance of appropriate staff capability and observance of internal BLM standards as set out in the 8100 Manual series. The New Mexico BLM also has a programmatic agreement or protocol with the New Mexico SHPO. This agreement details how the New Mexico BLM and SHPO will function under the national agreement. Specifically, this document outlines how and when consultation will be conducted between the BLM and others, including the SHPO, Tribal Historic Preservations Officers, Tribes, and the public. The New Mexico State Protocol also outlines when SHPO consultation is not required for specific federal undertakings and the procedures for evaluating effects of common types of undertakings. These common types of undertakings include the common actions undertaken in the FFO. The protocol agreement sets thresholds for case by case consultation and outlines SHPO monthly review of common undertakings.

4.2. List of Preparers

This EA was prepared by NCI in conformance with the standards of and under the direction of the BLM-FFO. The following individuals assisted in the preparation of this EA:

- John Leonhart, Senior Project Manager, NCI
- Amber Ballman, Senior Environmental Scientist
- Eric Creeden, Senior Environmental Scientist, NCI
- Sarah Griffin, Environmental Scientist, NCI
- Steve Fuller, LAC
- Deb Silverman, LAC
- Paul Stirniman, LAC
- Amanda Nisula, Planning and Environmental Specialist, BLM-FFO
- Sheila Williams, District Botanist, BLM-FFO
- Jillian Aragon, Land Law Examiner, BLM-FFO
- John Hansen, Wildlife Biologist, BLM-FFO
- John Kendall, Wildlife Management Biologist, BLM-FFO
- Jim Copeland, Archaeologist, BLM-FFO
- Esther Willetto, Tribal Program Coordinator, BLM-FFO
- Jeff Tafoya, Range Specialist, BLM-FFO
- Monica Tilden, Realty Specialist, BLM-FFO
- Heather Perry, Natural Resource Specialist, BLM-FFO
- Craig Willems, Environmental Protection Specialist, BLM-FFO

4.3. References

Allen, D., A. Pacsi, D. Sullivan, D.Z. Araiza, M. Harrison, and K. Keen. 2014a. Methane Emissions from Process Equipment at Natural Gas Production Sites in the United States: Pneumatic Controllers. *Environmental Science and Technology*, es5040156.

Allen, D., D. Sullivan, D.Z. Araiza, A. Pacsi, M. Harrison, and K. Keen. 2014b. Methane Emissions from Process Equipment at Natural Gas Production Sites in the United States: Liquid Unloadings. *Environmental Science and Technology*, es504015.

Boshell, Cynthia. 2010. Public Land Policy as a Cultural Empowerment Tool: The Federal Land Policy and Management Act of 1976 (FLPMA), with special emphasis on the California Traditional Gathering Policy. Internet Web Site: http://users.humboldt.edu/boshell/PDF/boshell_FLPMA.pdf. Accessed September 8, 2011.

Brugge, David M. 1993. An Investigation of AIRFA [American Indian Religious Freedom Act] Concerns Relating to the Fruitland Coal Gas Development Area. Albuquerque, New Mexico: Office of Contract Archaeology, University of New Mexico. Ms. on file at BLM-FFO.

Bureau of Land Management (BLM). 2003a. Farmington Proposed Resource Management Plan and Final Environmental Impact Statement (PRMP/FEIS). Farmington, New Mexico: BLM-FFO.

_____. 2003b. Farmington Resource Management Plan with Record of Decision. (RMP and ROD). Farmington, New Mexico: BLM-FFO.

_____. 2004. Notice to Lessees and Operators on Onshore Oil and Gas Leases Within the Jurisdiction of the Farmington Field Office - Management of Sound Generated by Oil and Gas Production and Transportation (NTL 04-2 FFO). Farmington, New Mexico: BLM-FFO.

_____. 2005. *Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities.* BLM Manual Supplement H-8100-1. New Mexico, Oklahoma, and Texas.

_____. 2008a. BLM Manual 6840: Special Status Species Management.

_____. 2008b. BLM National Environmental Policy Act Handbook H-1790-1. Washington, D.C.: BLM National Environment Policy Act Program Office of the Assistant Director, Renewable Resources and Planning.

_____. 2008c. Memorandum: Farmington Field Office (FFO) Special Management Species Policy 2008 Update. Farmington, New Mexico: BLM-FFO.

_____. 2011a. BLM New Mexico Sensitive Birds List. Revised August 2011.

_____. 2011b. BLM New Mexico Sensitive Mammals List. Revised July 2011.

_____. 2011c. BLM New Mexico Sensitive Molluscs, Crustaceans, and Arthropods List. Revised August 2011.

_____. 2011d. Roads Design Handbook. H-9113-1

_____. 2011e. BLM Roads National Inventory and Condition Assessment Guidance and Instructions. H-9113-2.

_____. 2012a. BLM New Mexico Sensitive Plants List. January.

_____. 2012b. prairie_dog_colonies.shp (Shapefile of recorded prairie dog colonies within the general BLM-FFO region). Provided by BLM-FFO 2012.

_____. 2013a. aztec_gilia_habitat (Shapefile of the new Aztec gilia and Brack's fishhook cactus potential habitat "zone"). Provided by the BLM-FFO September 26, 2013.

_____. 2013b. BLM-FFO Bare Soil Reclamation Procedures. Available at: http://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_planning/surface_use_plan_of.html. Accessed April 2013.

_____. 2014a. *Air Resources Technical Report for Oil and Gas Development.* Santa Fe: BLM.

_____. 2014b. Brack's Cactus Interim Guidance. Interim Memorandum No. NMF000-2014-010. February 24, 2014.

Bureau of Land Management (BLM) and U.S. Forest Service (USFS). 2007. The Gold Book: Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development – 4th Edition, revised in 2007.

Bureau of Land Management, Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers. 1997. Programmatic Agreement Among the Bureau of Land Management, the Advisory Council On Historic Preservation, and the National Conference Of State Historic Preservation Officers Regarding the Manner in Which BLM Will Meet its Responsibilities Under the National Historic Preservation Act. Available at: http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/coop_agencies.Par.88790.File.dat/PA_Final_03_1997.pdf.

Council on Environmental Quality (CEQ). 1997. Environmental Justice Guidance under the National Environmental Policy Act. December 10, 1997.

Environmental Protection Agency (EPA). 2004. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reserves. Office of Ground Water and Drinking Water (4606M). EPA 816-R-04-003.

_____. 2012. *2005 National-Scale Air Toxics Assessment*. http://www.epa.gov/ttn/atw/nata2005/. Accessed February 27, 2014.

_____. 2013a. *Air Quality Index Report*. http://www.epa.gov/airdata/ad_rep_aqi.html. Accessed March 12, 2014.

_____. 2013b. *The Green Book Nonattainment Areas for Criteria Pollutants*. http://www.epa.gov/airquality/greenbook/. Accessed February 25, 2014.

_____. 2014a. *Air Trends: Design Values*. http://www.epa.gov/airtrends/values.html. Accessed February 25, 2014.

_____. 2014b. *The 2011 National Emissions Inventory*. http://www.epa.gov/ttn/chief/net/2011inventory.html. Accessed February 27, 2014.

Eveling, D.W., and A. Bataille. 1984. The effect of deposits of small particles on the resistance of leaves and petals to water loss. Environmental Pollution. 36:229-238.

Griffith, G.E., J.M. Omernik, M.M. McGraw, G.Z Jacobi, C.M. Canavan, T.S. Schrader, D. Mercer, R. Hill, and B.C. Moran. 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs). Reston, Virginia: U.S. Geological Survey (map scale 1:1,400,000).

Hirano, T., M. Kiyota, and I. Aiga. 1995. Physical effects of dust on the leaf physiology of Cucumber and Kidnekbean plant. Environmental Pollution 89(3):225-261.

Holmes, A.L. and A.V. King. 2006. Vital Rates of Sagebrush Obligate Songbirds in Relation to Natural Gas Development and Weather. Abstract Oral Presentation to IV North American Ornithological Congress. Veracruz, Mexico.

Howarth, R., R. Santoro, and A. Ingraffea. 2011. Methane and the greenhouse-gas footprint of natural gas from shale formations. Climate Change, 679-690.

Intergovernmental Panel on Climate Change. 2013. Climate Change 2013: The Physical Science Basis. Cambridge: Cambridge University Press.

Kelly, Klara, Rena Martin, Richard Begay, Ted Neff, and Clifford Werito. 2006. We Will Help You With What We Know: Diné Traditional Cultural Places In Dinétah. Flagstaff, Arizona: Museum of Northern Arizona Environmental Solutions, Inc. Ms. on file at BLM-FFO.

Kort, E., C. Frankenberg, K. Costigan, R. Lindenmaier, M. Dubey, and D. Wunch. 2014. Four corners: The largest US methane anomaly viewed from space. Geophysical Research Letters, 6898-6903

La Plata Archaeological Consultants (LAC). 2015. Cultural Resources Survey of Encana Oil and Gas (USA) Inc.'s Pinyon Unit M16-2410 Numbers 01H-04H Multiple Well Pad, Access Road, and Pipeline, San Juan County, New Mexico. LAC Report 2012-1LLL.

Natural Gas Supply Association. 2010. NaturalGas.org – Uses of Natural Gas. Available at: http://www.naturalgas.org/overview/uses.asp.

New Mexico Bureau of Geology and Mineral Resources. 2012. Available at: http://geoinfo.nmt.edu/.

New Mexico Environment Department (NMED). 2010. *Inventory of New Mexico Greenhouse Gas Emissions: 2000-2007.* Santa Fe: New Mexico Environment Department.

New Mexico Office of the State Engineer. 2011. GIS shapefile: ose_wells_July2011. http://www.ose.state.nm.us/water_info_data.html.

Office of Natural Resources Revenue. 2012. Reported Royalty Revenue by Category – Fiscal Year 2011. Available at: http://www.onrr.gov/ONRRWebStats/Disbursements_Royalties.aspx?report=ReportedRoyaltyRevenuebyCategory&yeartype=FY&year=2011&datetype=AY.

Ortega, C.P. and C.D. Francis. 2007. Effects of Gas Well Compressor Noise on Breeding Birds in the Rattlesnake Canyon Habitat Management Area, San Juan County, New Mexico. Report to the Bureau of Land Management, Farmington Field Office. Final Report.

Schneising, O., J. P. Burrows, R.R. Dickerson, M. Buchwitz, M. Reuter, and H. Bovensmann. 2014. Remote sensing of fugitive methane emissions from oil and gas production in North American tight geologic formations. Earth's Future, 548-558.

Science Applications International Corporation. 2002. Cultural Resources Technical Report: Background Information on Cultural Resources for the Farmington Draft RMP/EIS. Ms. on file at BLM-FFO, Farmington, New Mexico.

Thompson, J. R., P.W. Mueller, W. Fluckiger, A.J. and Rutter. 1984. The effects of dust on photosynthesis and its significance for roadside plants. Environmental Pollution 34(2):171-190.

U.S. Census Bureau. 2010. American Fact Finder (2010 Census Data). Available at: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

_____. 2012a. Poverty threshold by size of family. Internet Web site: http://www.census.gov/hhes/www/poverty/data/threshld/index.html. Accessed on Accessed on February 20, 2014.

_____. 2012b. American Community Survey, 2012 American Community Survey 5-Year Estimates, Tables DP-02, DP-03, DP-04, DP-05; generated by Lauren Zielinski; using American FactFinder; http://factfinder2.census.gov. Accessed February 17, 2014.

_____. 2013. Small Area Estimates Branch 2002 and 2012 Poverty and Median Income Estimates - Release date December 2013. Accessed on February 20, 2014.

_____. 2014. US Census Bureau GIS data. Tiger Products. Internet Web Site: http://www.census.gov/geo/maps-data/data/tiger.html. Accessed on February 2014.

U.S. Department of Energy. 2011. Natural Gas Regulation. Available at: http://www.fossil.energy.gov/programs/gasregulation/index.html.

U.S. Energy Information Administration. 2012. Energy in Brief. Available at: http://www.eia.gov/energy_in_brief/major_energy_sources_and_users.cfm.

U.S. Fish and Wildlife Service (USFWS). 2014. IPaC – Information, Planning, and Conservation System. http://ecos.fws.gov/ipac/wizard/chooseLocation!prepare.action. Accessed April 2014.

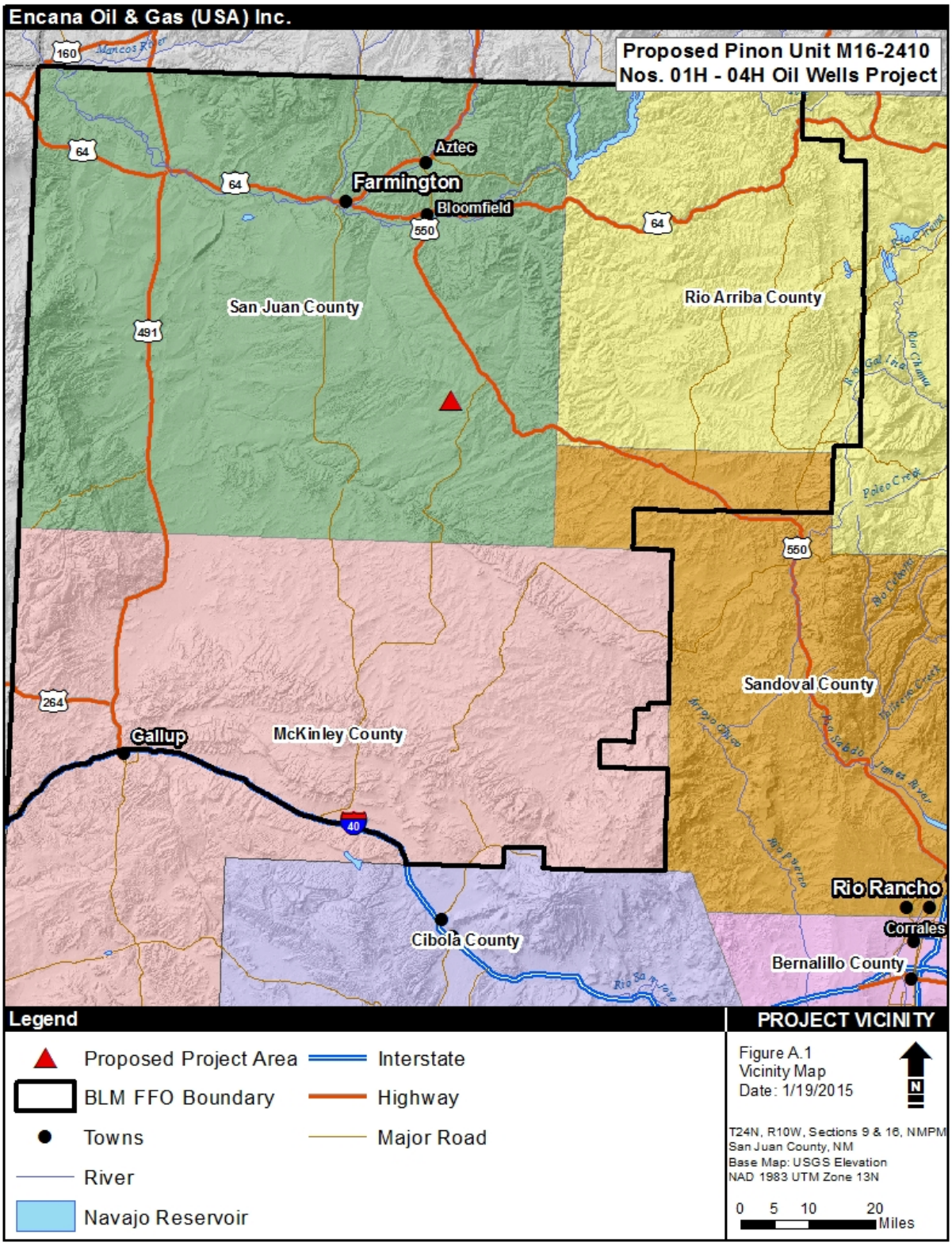
U.S. Geological Survey (USGS). 1979. Notice to Lessees and Operators of Onshore Federal and Indian Oil and Gas Leases (NTL-3A). Reporting of Undesirable Events.

Van Valkenburgh, R. F. 1941.Diné Bikeyah. Window Rock, Arizona: Department of the Interior, Office of Indian Affairs, Navajo Services. Ms. on file at BLM-FFO.

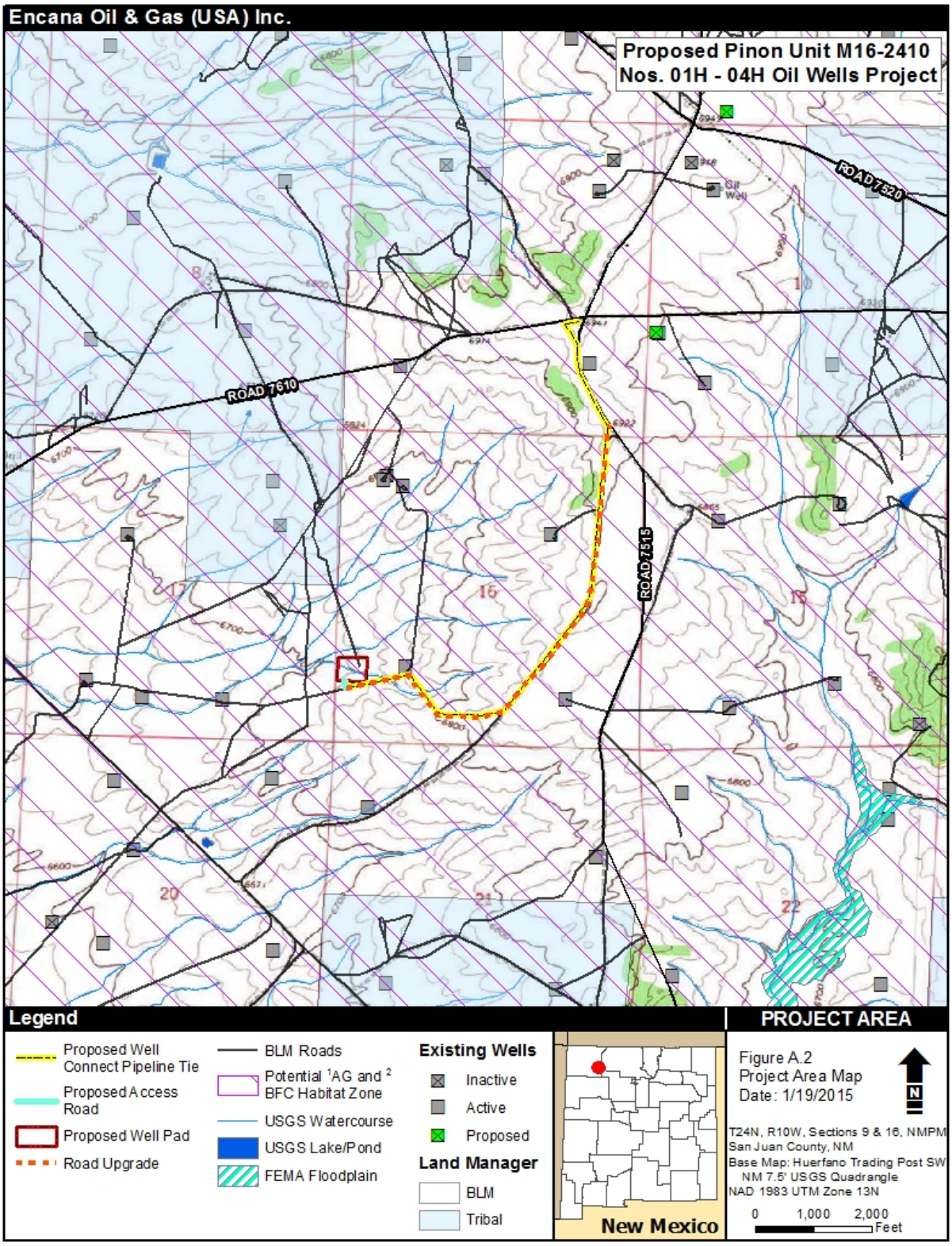
_____. 1974. Navajo Sacred Places. Edited by C. Kluckhohn. Garland American Indian Ethnohistory Series, Navajo Indians, 3 Vols. New York, New York: Garland Publishing.

APPENDIX A. MAPS

A.1. Vicinity Map

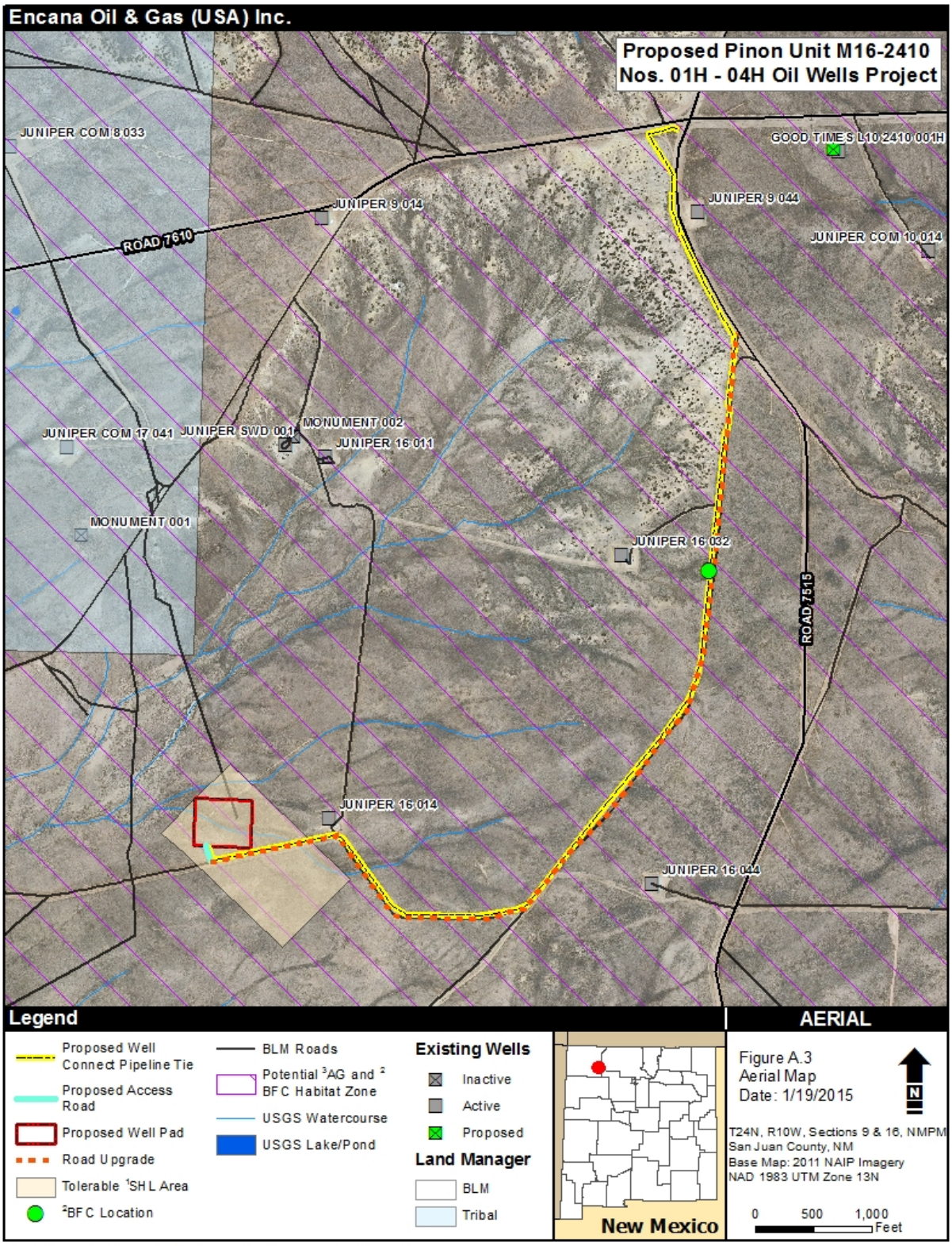


A.2. Project Area Map



[1] AG - Aztec Gilia [2] BFC - Brack's Fishhook Cactus

A.3. Aerial Map



[1] SHL - Surface Hole Location [2] BFC - Brack's Fishhook Cactus [3] AG - Aztec Gilia

APPENDIX B. BIOLOGICAL SURVEY REPORT

APPENDIX C. PLATS

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

DISTRICT II
811 S. First St., Artesia, N.M. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
Phone: (505) 334-6178 Fax: (505) 334-6170

DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011

Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
	98102	PIÑON UNIT HZ (OIL)

[4] Property Code	[5] Property Name	[6] Well Number
	PIÑON UNIT M16-2410	01H

[7] OGRID No.	[8] Operator Name	[9] Elevation
282327	ENCANA OIL & GAS (USA) INC.	6734.3'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
M	16	24N	10W		1278'	SOUTH	228'	WEST	SAN JUAN

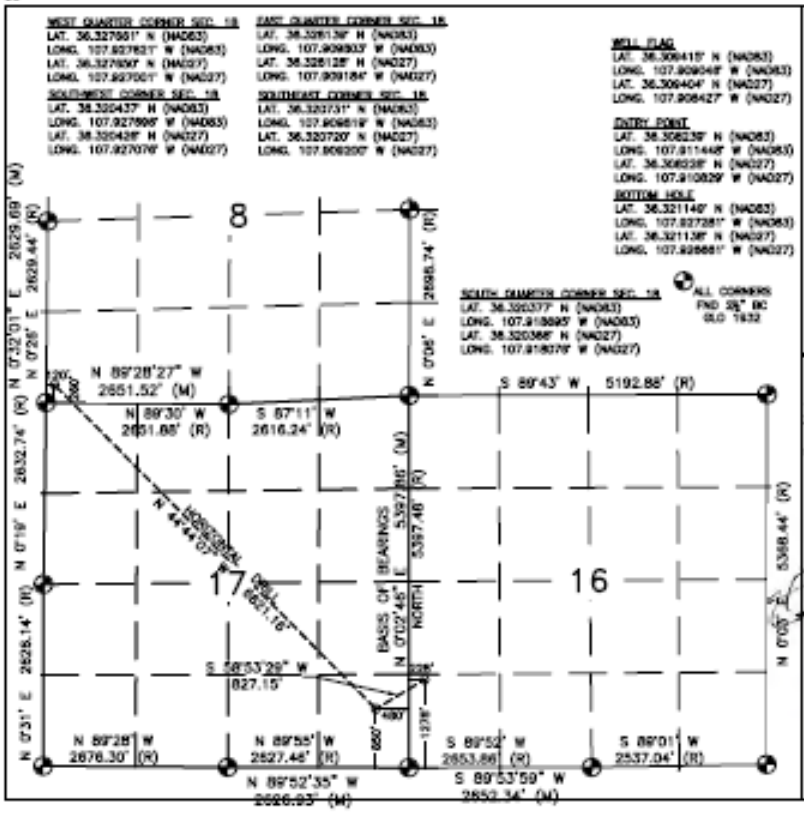
[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
M	8	24N	10W		260'	SOUTH	120'	WEST	SAN JUAN

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
7848.44 ACRES W/2 OF SEC. 4, SEC. 5-10, 15-18, 21, N/2 OF SEC. 22, & N/2 OF SEC. 28 - UNDIVIDED UNIT, PENETRATED SPACING UNITS: ALL SEC. 17, S/2 SEC. 16			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

16



OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Signature Date

Printed Name

E-mail Address

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

DECEMBER 4, 2014

Date of Survey

Signature and Seal of Professional Surveyor:

DAVID RUSSELL
Certificate Number 10201

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

DISTRICT II
811 S. First St., Artesia, N.M. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
Phone: (505) 334-6178 Fax: (505) 334-6170

DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011

Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
	98102	PIÑON UNIT HZ (OIL)

[4] Property Code	[5] Property Name	[6] Well Number
	PIÑON UNIT M16-2410	02H

[7] OGRID No.	[8] Operator Name	[9] Elevation
282327	ENCANA OIL & GAS (USA) INC.	6734.3'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
M	16	24N	10W		1278'	SOUTH	258'	WEST	SAN JUAN

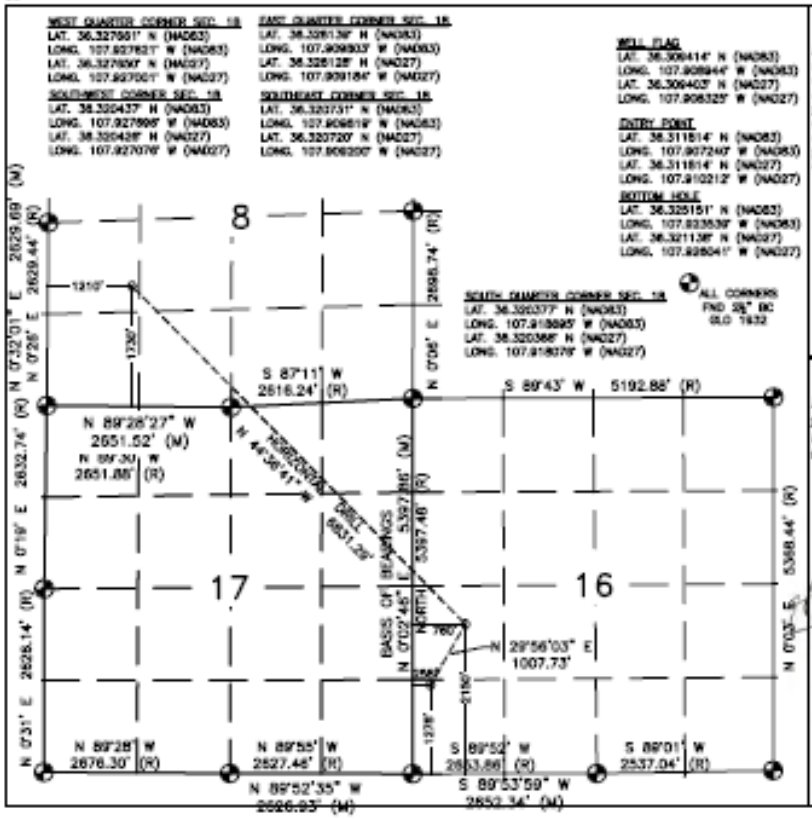
[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
L	8	24N	10W		1730'	SOUTH	1210'	WEST	SAN JUAN

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
PROJECT AREA 7848.44 ACRES W/2 OF SEC. 4, SEC. 5-10, 15-18, 21, N/2 OF SEC. 22, & N/2 OF SEC. 28 - UNDIVIDED UNIT, PENETRATED SPACING UNITS: N/2 SEC. 17, S/2 SEC. 16			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

16



OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Signature Date

Printed Name

E-mail Address

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

DECEMBER 4, 2014

Date of Survey

Signature and Seal of Professional Surveyor:

DAVID E. RUSSELL NEW MEXICO 10201 REGISTERED PROFESSIONAL ENGINEER AND SURVEYOR

DAVID RUSSELL

Certificate Number 10201

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

DISTRICT II
811 S. First St., Artesia, N.M. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
Phone: (505) 334-6178 Fax: (505) 334-6170

DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011

Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
	98102	PIÑON UNIT HZ (OIL)

[4] Property Code	[5] Property Name	[6] Well Number
	PIÑON UNIT M16-2410	03H
[7] OGRID No.	**[8] Operator Name**	**[9] Elevation**
282327	ENCANA OIL & GAS (USA) INC.	6734.3'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
M	16	24N	10W		1277'	SOUTH	288'	WEST	SAN JUAN

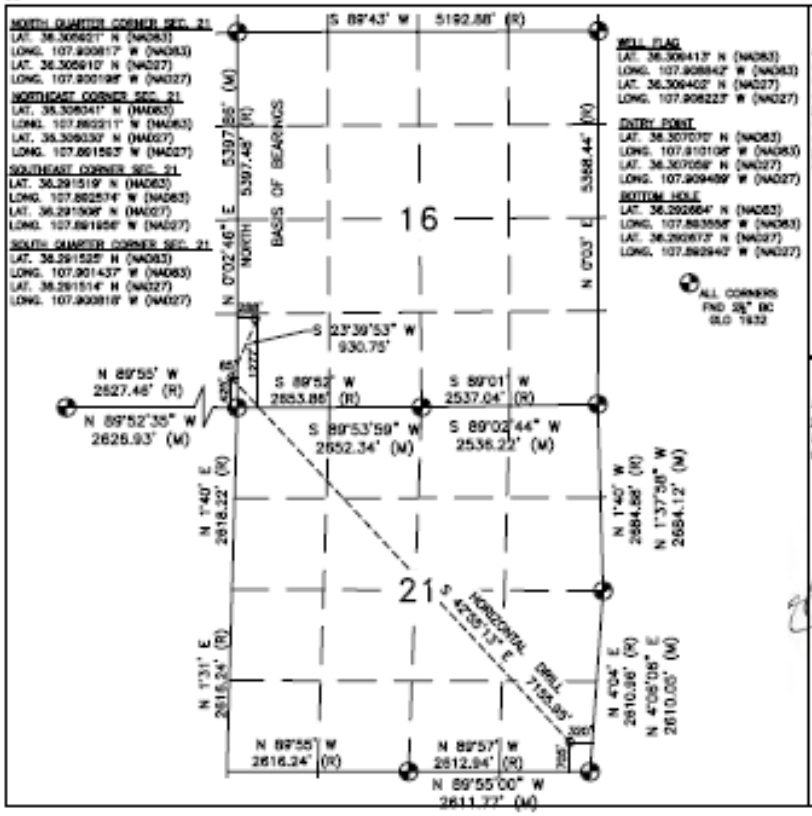
[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
P	21	24N	10W		705'	SOUTH	320'	EAST	SAN JUAN

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
7948.44 ACRES W/2 OF SEC. 4, SEC. 5-10, 15-18, 21, N/2 OF SEC. 22, & N/2 OF SEC. 28 - UNDIVIDED UNIT, PENETRATED SPACING UNITS: ALL SEC. 21			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

16



OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Signature Date

Printed Name

E-mail Address

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

DECEMBER 4, 2014

Date of Survey

Signature and Seal of Professional Surveyor:

DAVID E. RUSSELL NEW MEXICO 10201 REGISTERED PROFESSIONAL ENGINEER AND SURVEYOR

DAVID RUSSELL

Certificate Number 10201

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

DISTRICT II
811 S. First St., Artesia, N.M. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
Phone: (505) 334-6178 Fax: (505) 334-6170

DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011

Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
	98102	PIÑON UNIT HZ (OIL)

[4] Property Code	[5] Property Name	[6] Well Number
	PIÑON UNIT M16-2410	04H

[7] OGRID No.	[8] Operator Name	[9] Elevation
282327	ENCANA OIL & GAS (USA) INC.	6734.3'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
M	16	24N	10W		1277'	SOUTH	318'	WEST	SAN JUAN

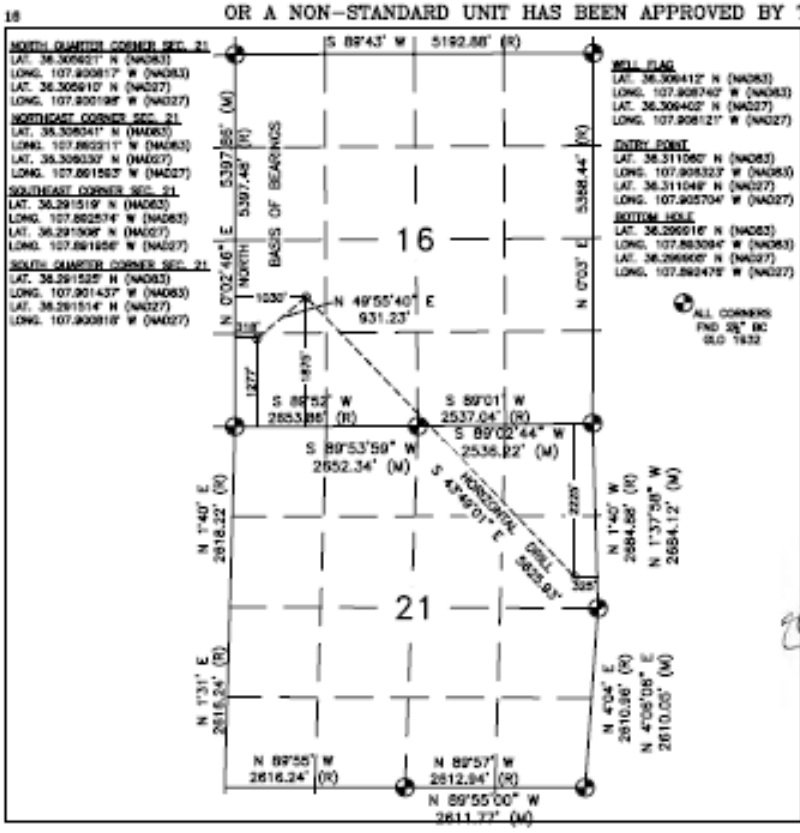
[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
H	21	24N	10W		2225	NORTH	325'	EAST	SAN JUAN

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
PROJECT AREA 7848.44 ACRES W/2 OF SEC. 4, SEC. 5-10, 15-18, 21, N/2 OF SEC. 22, & N/2 OF SEC. 28 - UNDIVIDED UNIT, PENETRATED SPACING UNITS: S/2 SEC. 16, N/2 SEC. 21			

NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

16



OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Signature Date

Printed Name

E-mail Address

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

DECEMBER 4, 2014

Date of Survey

Signature and Seal of Professional Surveyor:

DAVID RUSSELL

Certificate Number 10201

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720

DISTRICT II
811 S. First St., Artesia, N.M. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720

DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
Phone: (505) 334-6178 Fax: (505) 334-6170

DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department

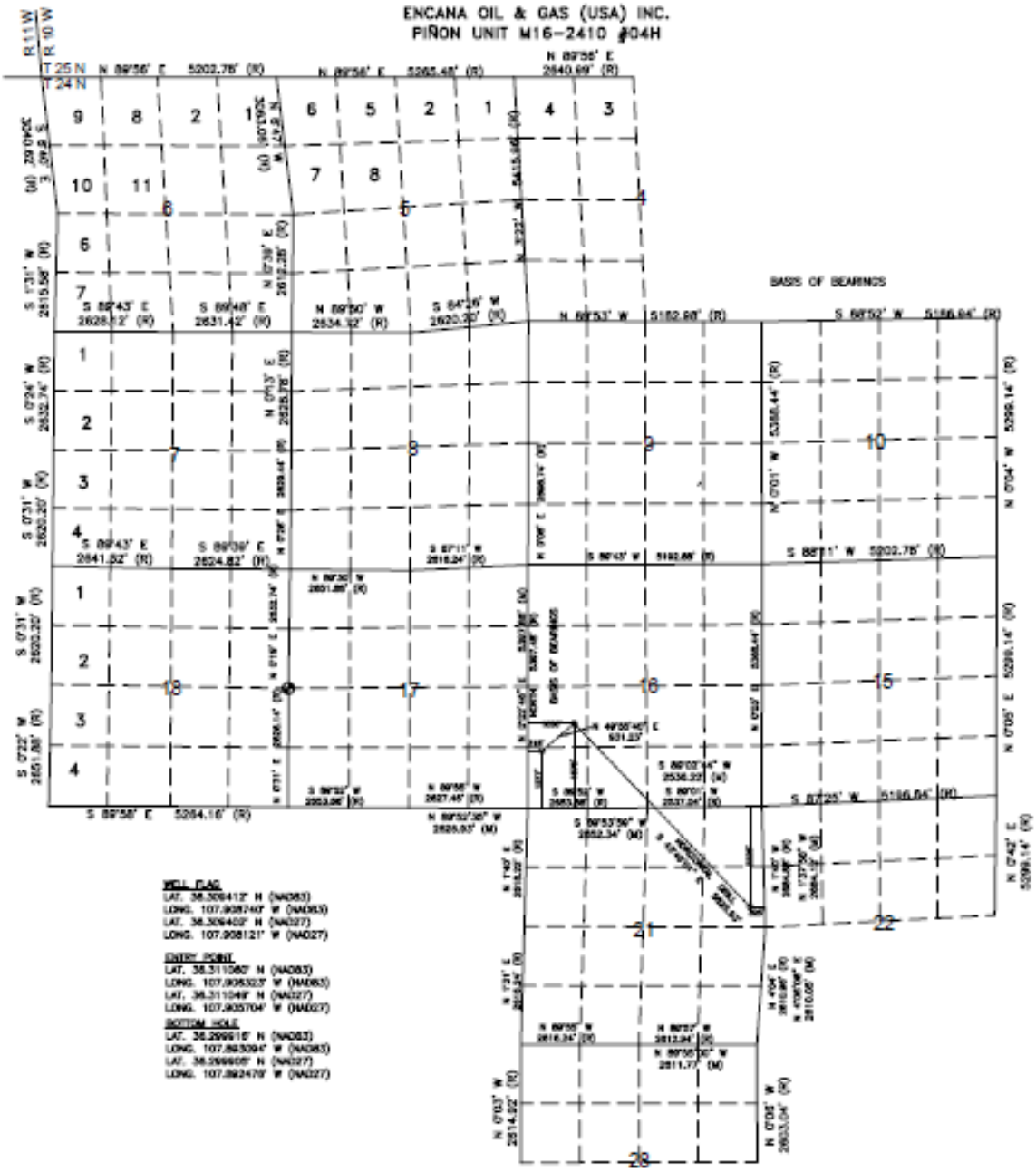
OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011

Submit one copy to appropriate District Office

☐ AMENDED REPORT

ENCANA OIL & GAS (USA) INC.
PIÑON UNIT M16-2410 #04H



WELL FLAG
LATITUDE: 36.309412° N
LONGITUDE: 107.908740° W
DATUM: NAD83

ENCANA OIL & GAS (USA) INC.

PIÑON UNIT M16-2410 #04H
1277' FSL & 318' FWL
LOCATED IN THE SW/4 SW/4 OF SECTION 16, T24N, R10W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO
GROUND ELEVATION: 6734', NAVD 88
FINISHED PAD ELEVATION: 6734.3', NAVD 88

TN MN 9.5° E
50' 0 50' 100'
SCALE = 100'

NOTES:

1.) BASIS OF BEARING: BETWEEN FOUND MONUMENTS AT THE SOUTHWEST CORNER AND THE NORTHWEST CORNER OF SECTION 16, TOWNSHIP 24 NORTH, RANGE 10 WEST, N.M.P.M. SAN JUAN COUNTY, NEW MEXICO.
LINE BEARS: N 0°02'46" E A DISTANCE OF 5397.86 FEET AS MEASURED BY G.P.S.

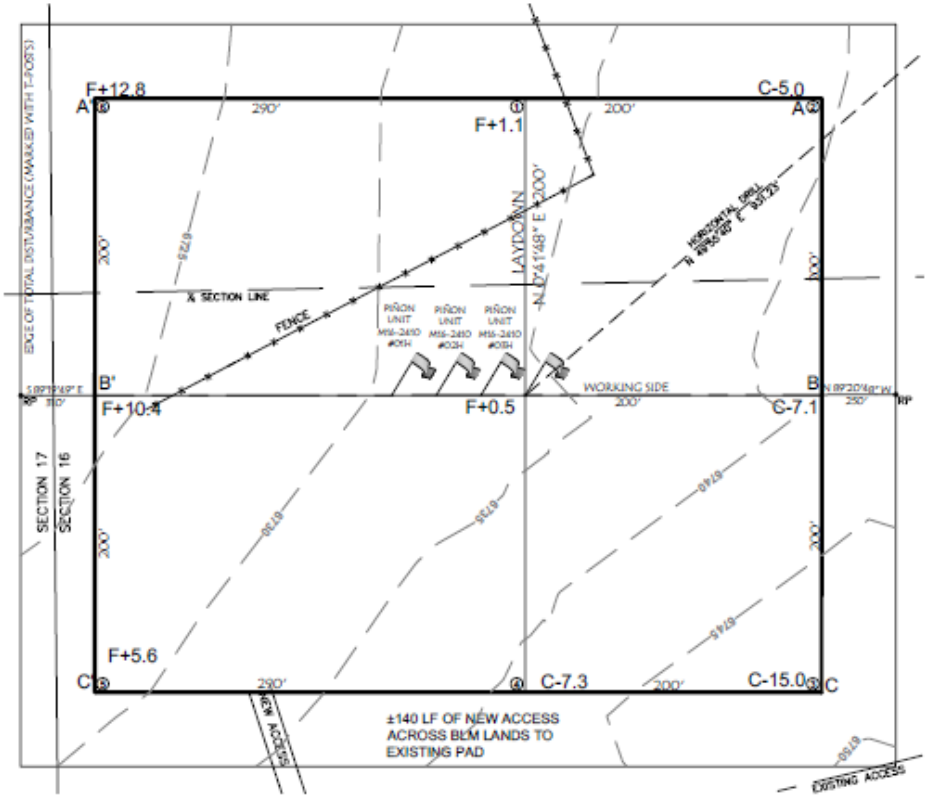
2.) LATITUDE, LONGITUDE AND ELLIPSOIDAL HEIGHT BASED ON AZTEC CORS L1 PHASE CENTER. DISTANCES SHOWN ARE GROUND DISTANCES USING A TRAVERSE MERCATOR PROJECTION FROM A WGS84 ELLIPSOID, CONVERTED TO NAD83. NAVD88 ELEVATIONS AS PREDICTED BY GEOID03.

3.) LOCATION OF UNDERGROUND UTILITIES DEPICTED ARE APPROXIMATE. PRIOR TO EXCAVATION UNDERGROUND UTILITIES SHOULD BE FIELD VERIFIED. ALL CONSTRUCTION ACTIVITIES SHOULD BE FIELD VERIFIED WITH NEW MEXICO ONE-CALL AUTHORITIES AT LEAST 48 HOURS PRIOR TO CONSTRUCTION.

4.) T-POSTS HAVE BEEN SET TO DEFINE THE EDGE OF DISTURBANCE LIMITS WHICH ARE 50' OFFSETS FROM THE EDGE OF THE STAKED WELL PAD.

~ SURFACE OWNERSHIP ~
BUREAU OF LAND MANAGEMENT

SLOPES TO BE CONSTRUCTED TO MATCH THE ORIGINAL CONTOURS AS CLOSE AS POSSIBLE.



TOTAL PERMITTED AREA
5 FOOT CONTOUR INTERVAL SHOWN
500' x 590' = 6.77 ACRES
SCALE: 1" = 100'
JOB No.: ENC040
DATE: 12/06/2014
DRAWN BY: TWT

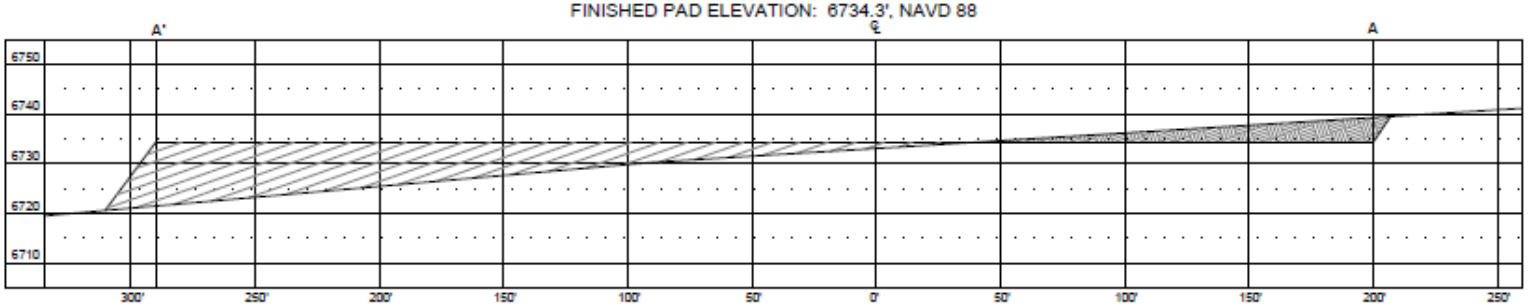
NOTE:
SCORPION SURVEY & CONSULTING, L.L.C. IS NOT LIABLE FOR UNDERGROUND UTILITIES OR PIPELINES. CONTRACTOR SHOULD CALL ONE-CALL FOR LOCATION OF ANY MARKED OR UNMARKED, BURIED PIPELINES OR CABLES ON WELL PAD, IN CONSTRUCTION ZONE AND/OR ACCESS ROAD AT LEAST TWO (2) WORKING DAYS PRIOR TO CONSTRUCTION.

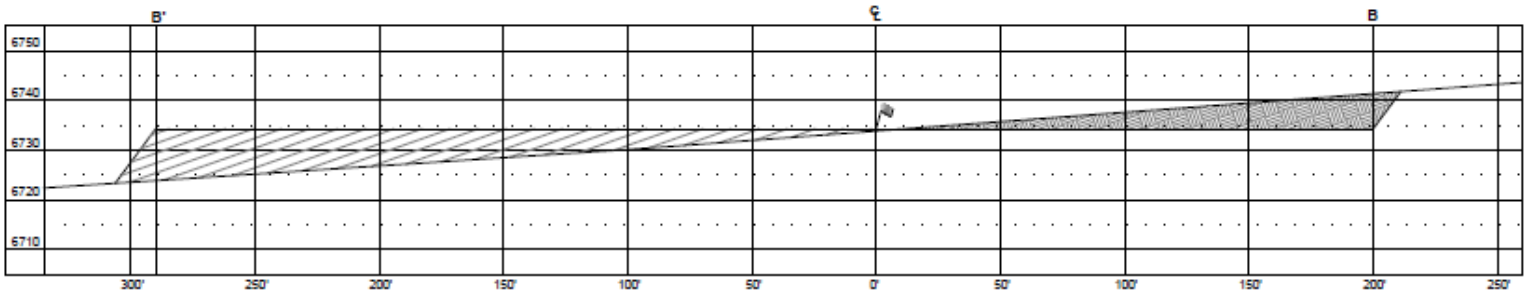
Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

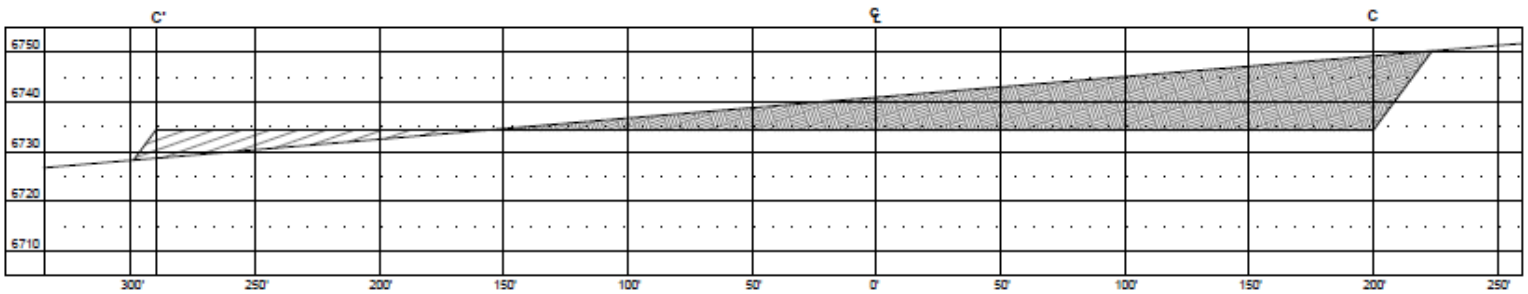
WELL FLAG
LATITUDE: 36.309412° N
LONGITUDE: 107.908740° W
DATUM: NAD83

ENCANA OIL & GAS (USA) INC.

PIÑON UNIT M16-2410 #04H
1277' FSL & 318' FWL
LOCATED IN THE NE/4 SE/4 OF SECTION 16, T24N, R10W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO
GROUND ELEVATION: 6734', NAVD 88
FINISHED PAD ELEVATION: 6734.3', NAVD 88







VERT. SCALE: 1" = 30'
HORZ. SCALE: 1" = 60'
JOB No.: ENC040
DATE: 12/06/2014
DRAWN BY: TWT

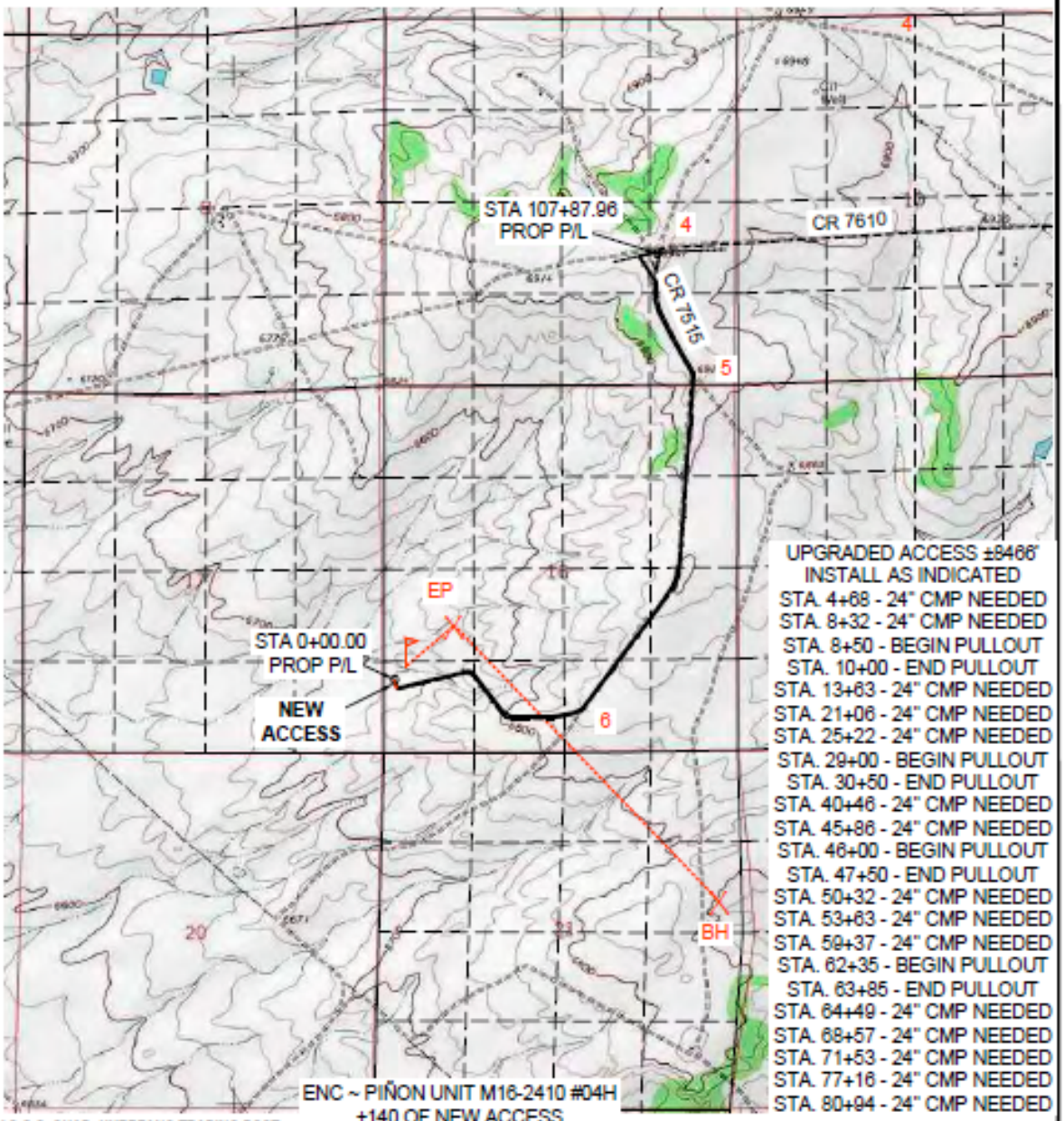
THIS DIAGRAM IS AN ESTIMATE OF DIRT BALANCE AND IS NOT INTENDED TO BE AN EXACT MEASURE OF VOLUME

FILL CUT

Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

WELL FLAG
LATITUDE: 36.309412° N
LONGITUDE: 107.908740° W
DATUM: NAD83

ENCANA OIL & GAS (USA) INC.
PIÑON UNIT M16-2410 #04H
1277' FSL & 318' FWL
LOCATED IN THE NE/4 SE/4 OF SECTION 16,
T24N, R10W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO
GROUND ELEVATION: 6734', NAVD 88
±140 OF NEW ACCESS ACROSS BLM LANDS



UPGRADED ACCESS ±8466'
INSTALL AS INDICATED
STA. 4+68 - 24" CMP NEEDED
STA. 8+32 - 24" CMP NEEDED
STA. 8+50 - BEGIN PULLOUT
STA. 10+00 - END PULLOUT
STA. 13+63 - 24" CMP NEEDED
STA. 21+06 - 24" CMP NEEDED
STA. 25+22 - 24" CMP NEEDED
STA. 29+00 - BEGIN PULLOUT
STA. 30+50 - END PULLOUT
STA. 40+46 - 24" CMP NEEDED
STA. 45+86 - 24" CMP NEEDED
STA. 46+00 - BEGIN PULLOUT
STA. 47+50 - END PULLOUT
STA. 50+32 - 24" CMP NEEDED
STA. 53+63 - 24" CMP NEEDED
STA. 59+37 - 24" CMP NEEDED
STA. 62+35 - BEGIN PULLOUT
STA. 63+85 - END PULLOUT
STA. 64+49 - 24" CMP NEEDED
STA. 68+57 - 24" CMP NEEDED
STA. 71+53 - 24" CMP NEEDED
STA. 77+16 - 24" CMP NEEDED
STA. 80+94 - 24" CMP NEEDED

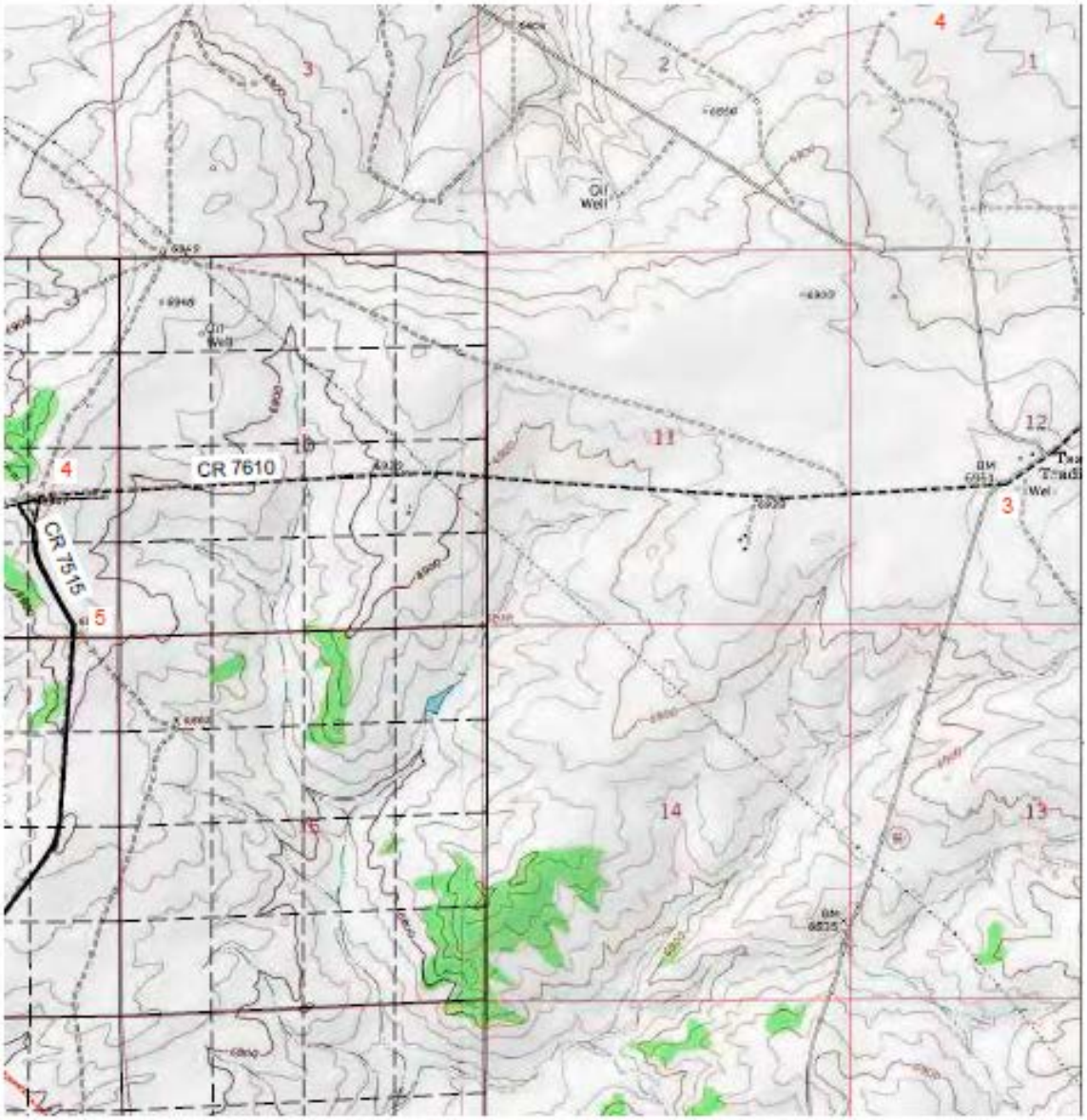
U.S.G.S. QUAD: HUERFANO TRADING POST
SCALE: 1" = 2000' (1:24,000)
JOB No.: ENC040
DATE: 12/06/2014
DRAWN BY: TWT

ENC ~ PIÑON UNIT M16-2410 #04H
±140 OF NEW ACCESS
INSTALL NEW 24" CMP
STA. 0+00 - BEGIN ACCESS
STA. 1+40.45 - @ PAD

Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

WELL FLAG
LATITUDE: 36.309412° N
LONGITUDE: 107.908740° W
DATUM: NAD83

ENCANA OIL & GAS (USA) INC.
PIÑON UNIT M16-2410 #04H
1277' FSL & 318' FWL
LOCATED IN THE NE/4 SE/4 OF SECTION 16,
T24N, R10W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO
GROUND ELEVATION: 6734', NAVD 88
±140 OF NEW ACCESS ACROSS BLM LANDS

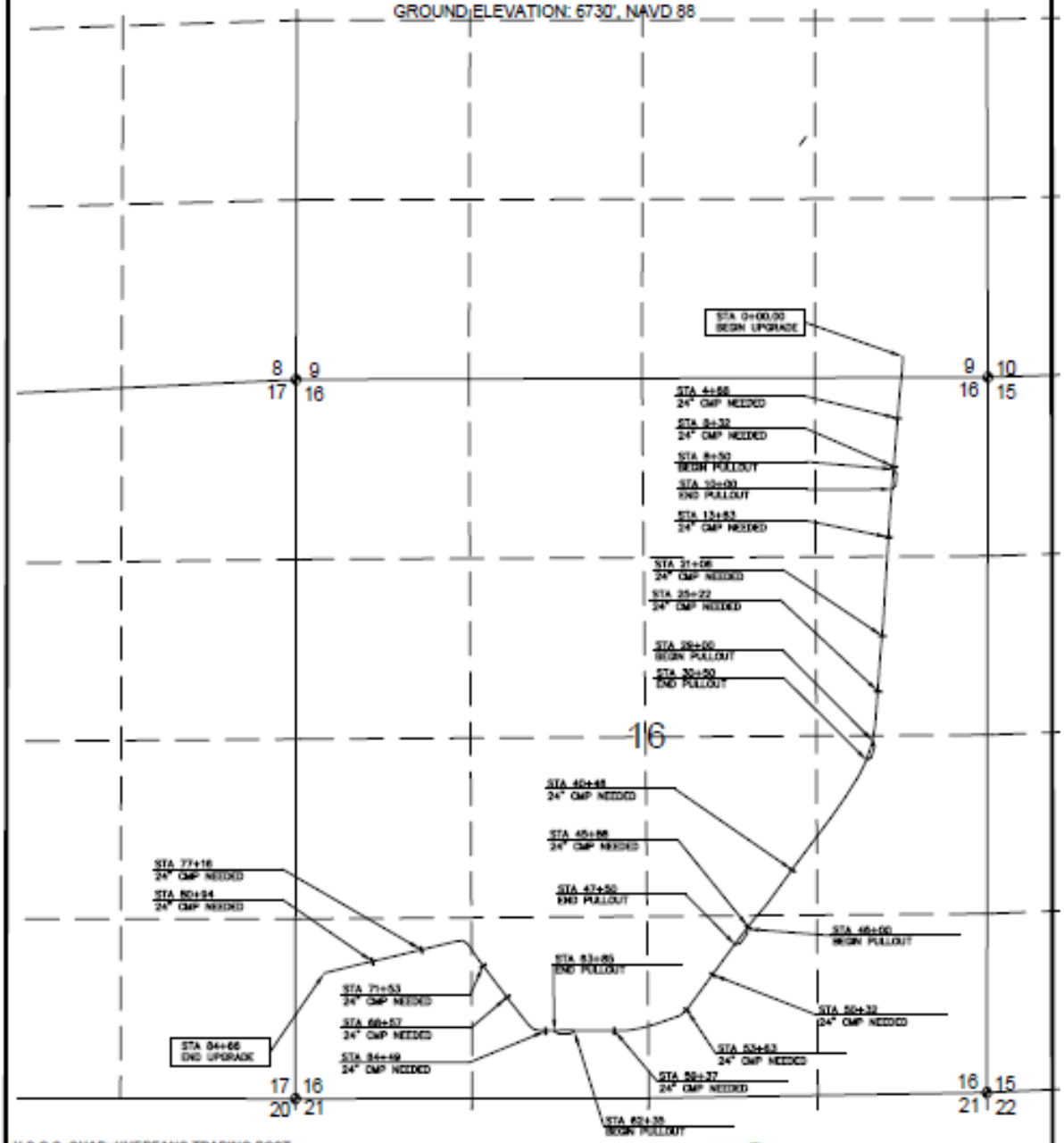


U.S.G.S. QUAD: HUERFANO TRADING POST
SCALE: 1" = 2000' (1:24,000)
JOB No.: ENC040
DATE: 12/06/2014
DRAWN BY: TWT

Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

WELL FLAG
LATITUDE: 36.309412° N
LONGITUDE: 107.908740° W
DATUM: NAD83

ENCANA OIL & GAS (USA) INC.
EXHIBIT "A"
PIÑON UNIT M16-2410 #04H
UPGRADED EXISTING ROAD
LOCATED IN THE N/2 SE/4, SE/4 SE/4 OF SECTION 9,
E/2 NE/4, NE/4 SE/4, W/2 SE/4, S/2 SW/4 OF SECTION 16
T24N, R10W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO
GROUND ELEVATION: 6730', NAVD 88



U.S.G.S. QUAD: HUERFANO TRADING POST
SCALE: 1" = 2000' (1:24,000)
JOB No.: ENC040
DATE: 12/06/2014
DRAWN BY: TWT

Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

PROPOSED ACCESS FOR

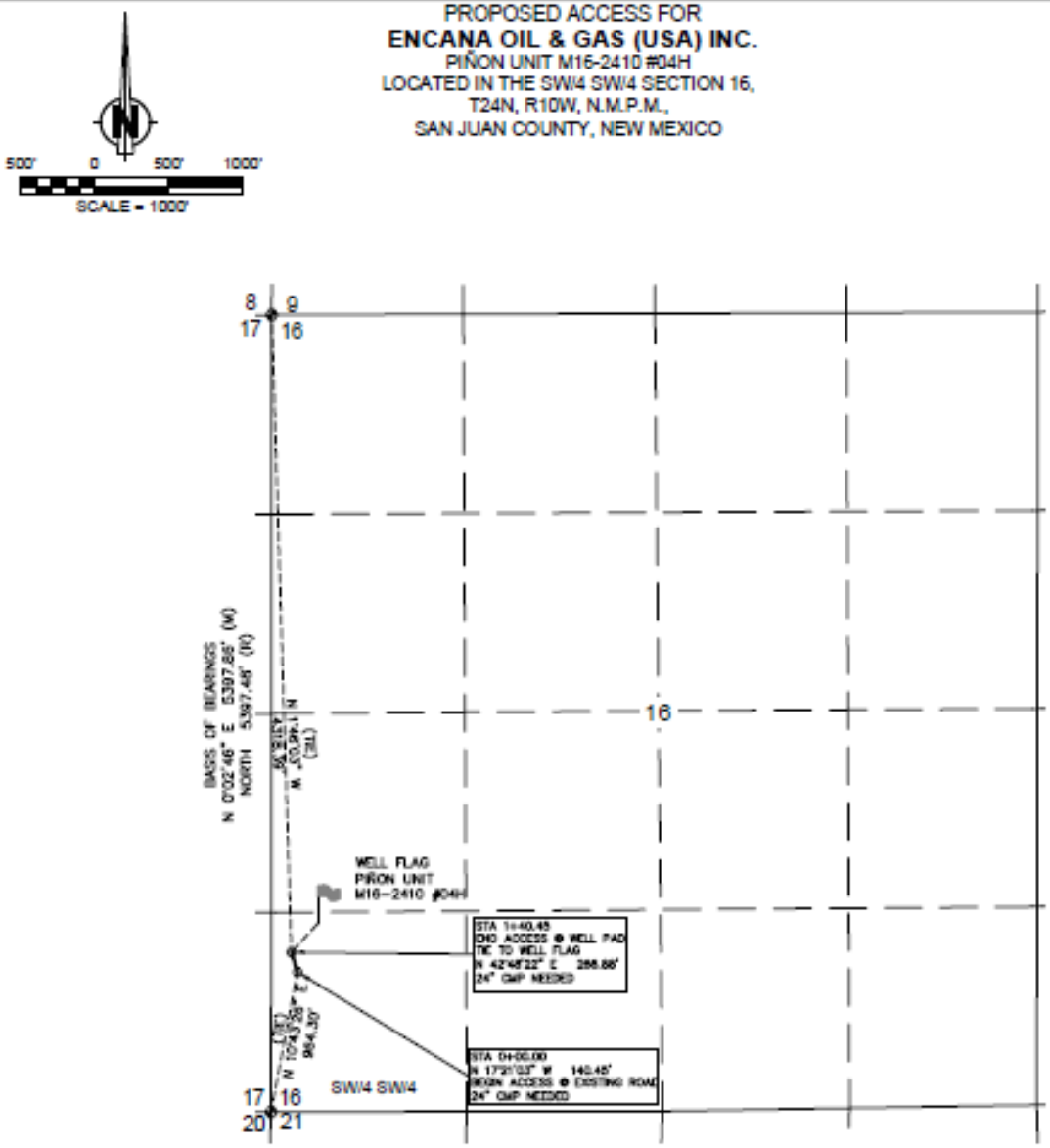
ENCANA OIL & GAS (USA) INC.

PIÑON UNIT M16-2410 #04H

LOCATED IN THE SW/4 SW/4 SECTION 16,

T24N, R10W, N.M.P.M.,

SAN JUAN COUNTY, NEW MEXICO



NOTES:

1.) BASIS OF BEARING BETWEEN FOUND MONUMENTS AT THE SOUTHWEST CORNER AND THE NORTHWEST CORNER OF SECTION 16, TOWNSHIP 24 NORTH, RANGE 10 WEST, N.M.P.M. SAN JUAN COUNTY, NEW MEXICO. LINE BEARS: N 0°02'46" E A DISTANCE OF 5397.86 FEET AS MEASURED BY G.P.S.

2.) LOCATION OF UNDERGROUND UTILITIES DEPICTED ARE APPROXIMATE. PRIOR TO EXCAVATION UNDERGROUND UTILITIES SHOULD BE FIELD VERIFIED. ALL CONSTRUCTION ACTIVITIES SHOULD BE FIELD VERIFIED WITH NEW MEXICO ONE-CALL AUTHORITIES AT LEAST 48 HOURS TO CONSTRUCTION.

I, DAVID R. RUSSELL, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR CERTIFY THAT I CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

DAVID R. RUSSELL, PLS
NEW MEXICO L.S. #10201

DATE: 12/09/2014

DAVID R. RUSSELL NEW MEXICO 10201 REGISTERED PROFESSIONAL LAND SURVEYOR

~ SURFACE OWNERSHIP ~ BUREAU OF LAND MANAGEMENT		
SECTION 16 0+00 TO 1+40.45 140.45 FT / 8.51 RODS		
DATE OF SURVEY	12/04/14	JC,SA

JOB No.: ENC040 DATE: 12/06/2014 DRAWN BY: TWT

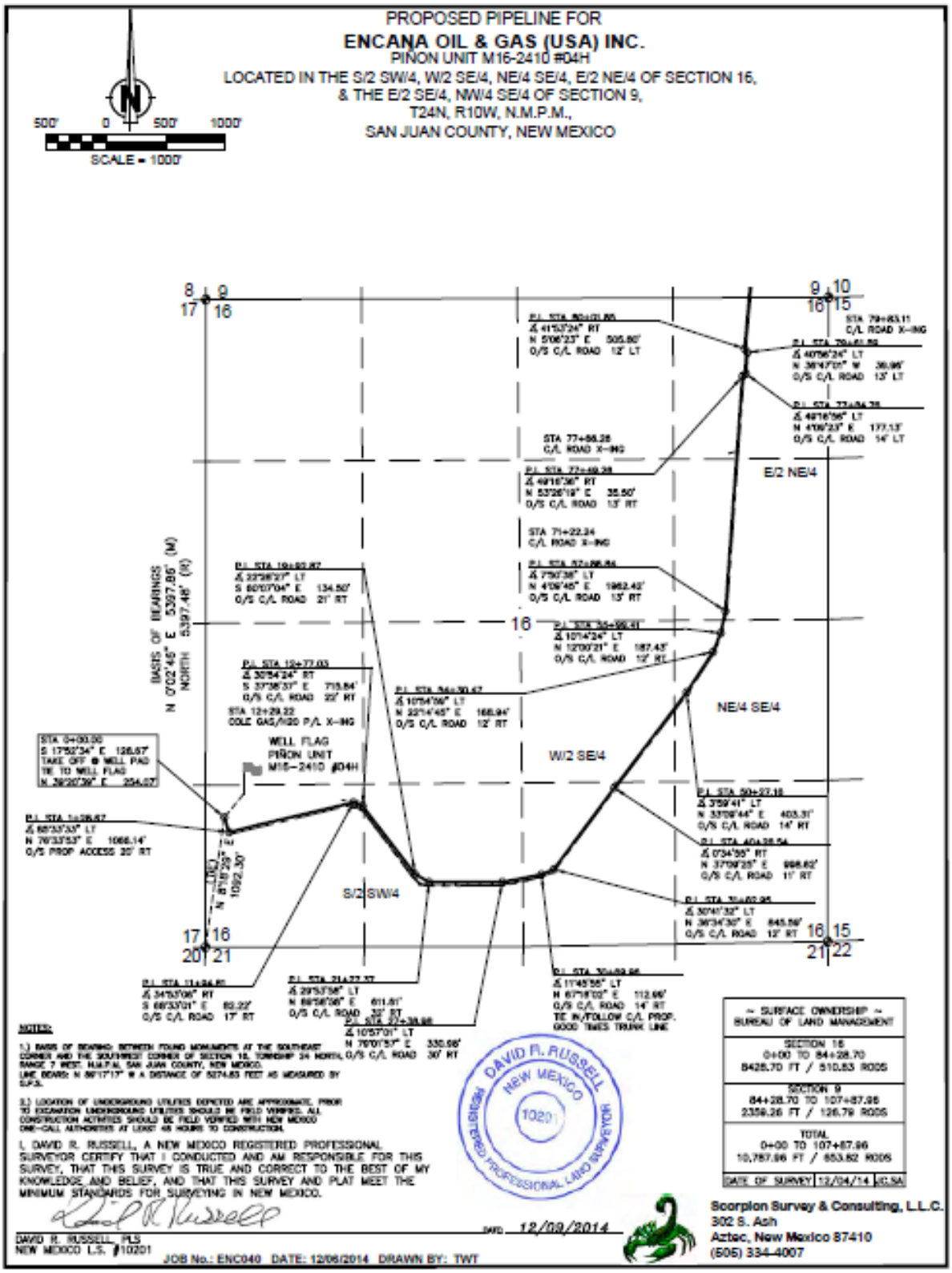
Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

PROPOSED PIPELINE FOR

ENCANA OIL & GAS (USA) INC.

PIÑON UNIT M16-2410 #04H

LOCATED IN THE S/2 SW/4, W/2 SE/4, NE/4 SE/4, E/2 NE/4 OF SECTION 16,
& THE E/2 SE/4, NW/4 SE/4 OF SECTION 9,
T24N, R10W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO



NOTES:

1.) BASIS OF BEARING: BETWEEN FOUND MONUMENTS AT THE SOUTHEAST CORNER AND THE SOUTHWEST CORNER OF SECTION 16, TOWNSHIP 24 NORTH, RANGE 7 WEST, N.M.P.M., SAN JUAN COUNTY, NEW MEXICO. LINE BEARS: N 88°17'17" W A DISTANCE OF 5274.83 FEET AS MEASURED BY G.P.S.

2.) LOCATION OF UNDERGROUND UTILITIES DEPICTED ARE APPROXIMATE. PRIOR TO EXCAVATION UNDERGROUND UTILITIES SHOULD BE FIELD VERIFIED. ALL CONSTRUCTION ACTIVITIES SHOULD BE FIELD VERIFIED WITH NEW MEXICO ONE-CALL AUTHORITIES AT LEAST 48 HOURS TO CONSTRUCTION.

I, DAVID R. RUSSELL, A NEW MEXICO REGISTERED PROFESSIONAL SURVEYOR CERTIFY THAT I CONDUCTED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

DAVID R. RUSSELL, PLS
NEW MEXICO L.S. #10201

DATE 12/09/2014

DAVID R. RUSSELL NEW MEXICO 10201 REGISTERED PROFESSIONAL LAND SURVEYOR

~ SURFACE OWNERSHIP ~ BUREAU OF LAND MANAGEMENT	
SECTION 16 0+00 TO 84+28.70 8428.70 FT / 510.83 RODS	
SECTION 9 84+28.70 TO 107+87.66 2359.26 FT / 126.79 RODS	
TOTAL 0+00 TO 107+87.66 10,787.66 FT / 653.62 RODS	
DATE OF SURVEY	12/04/14 LC.SA

JOB No.: ENC040 DATE: 12/06/2014 DRAWN BY: TWT

Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

PROPOSED PIPELINE FOR

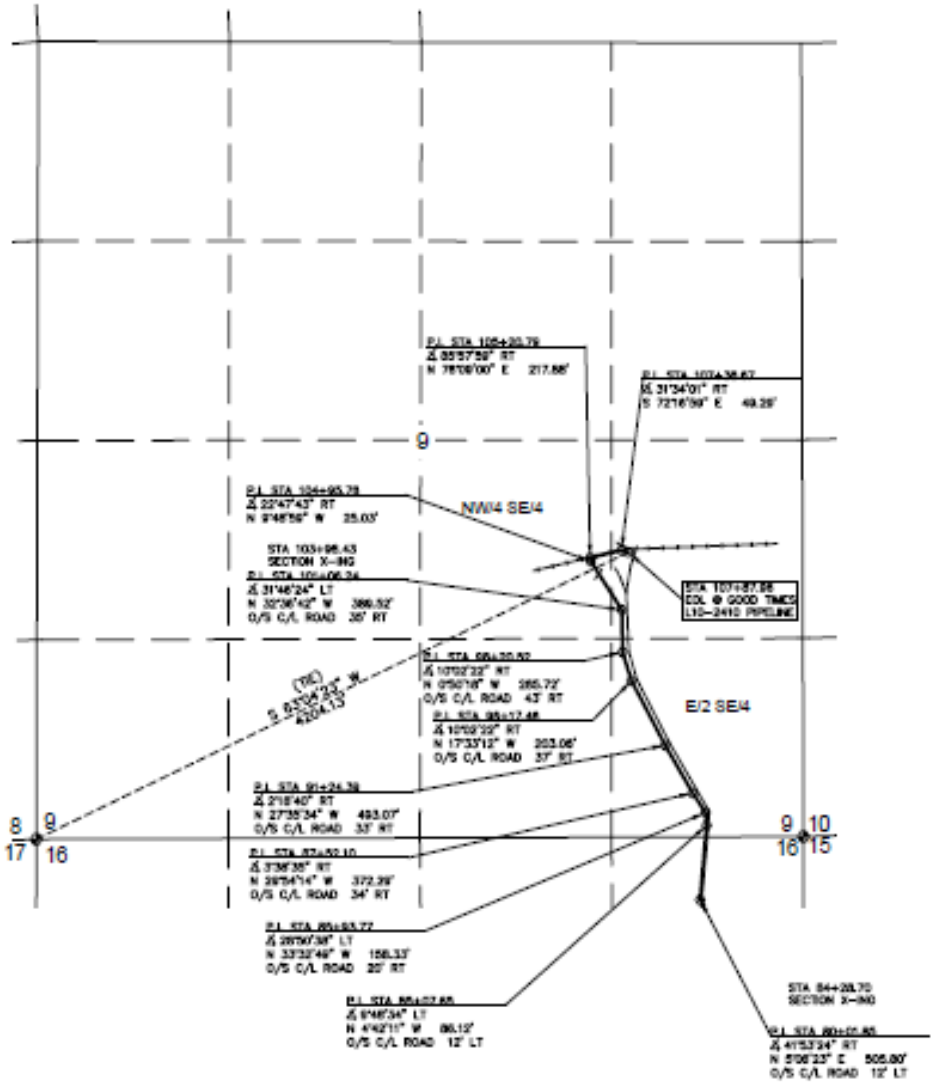
ENCANA OIL & GAS (USA) INC.

PIÑON UNIT M16-2410 #04H

LOCATED IN THE S/2 SW/4, W/2 SE/4, NE/4 SE/4, E/2 NE/4 OF SECTION 16,
& THE E/2 SE/4, NW/4 SE/4 OF SECTION 9,
T24N, R10W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO

500' 0 500' 1000'

SCALE = 1000'

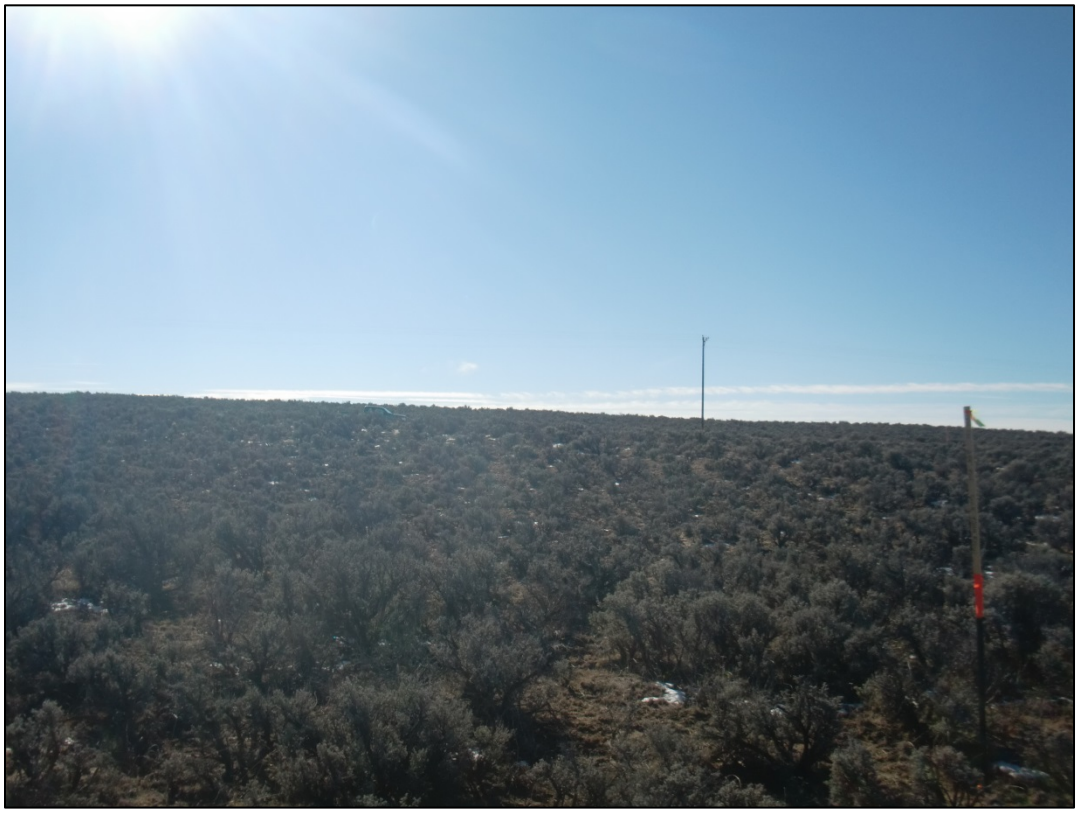


Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

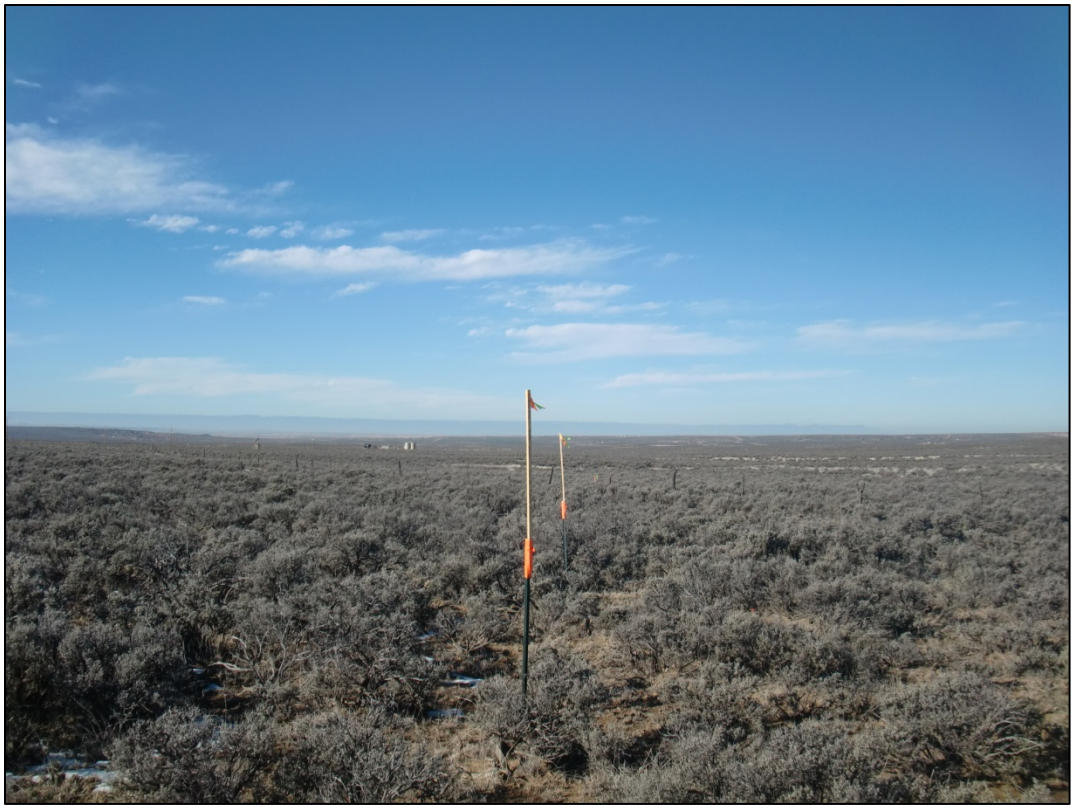
JOB No.: ENC040 DATE: 12/06/2014 DRAWN BY: TWT

APPENDIX D. PHOTOGRAPHS

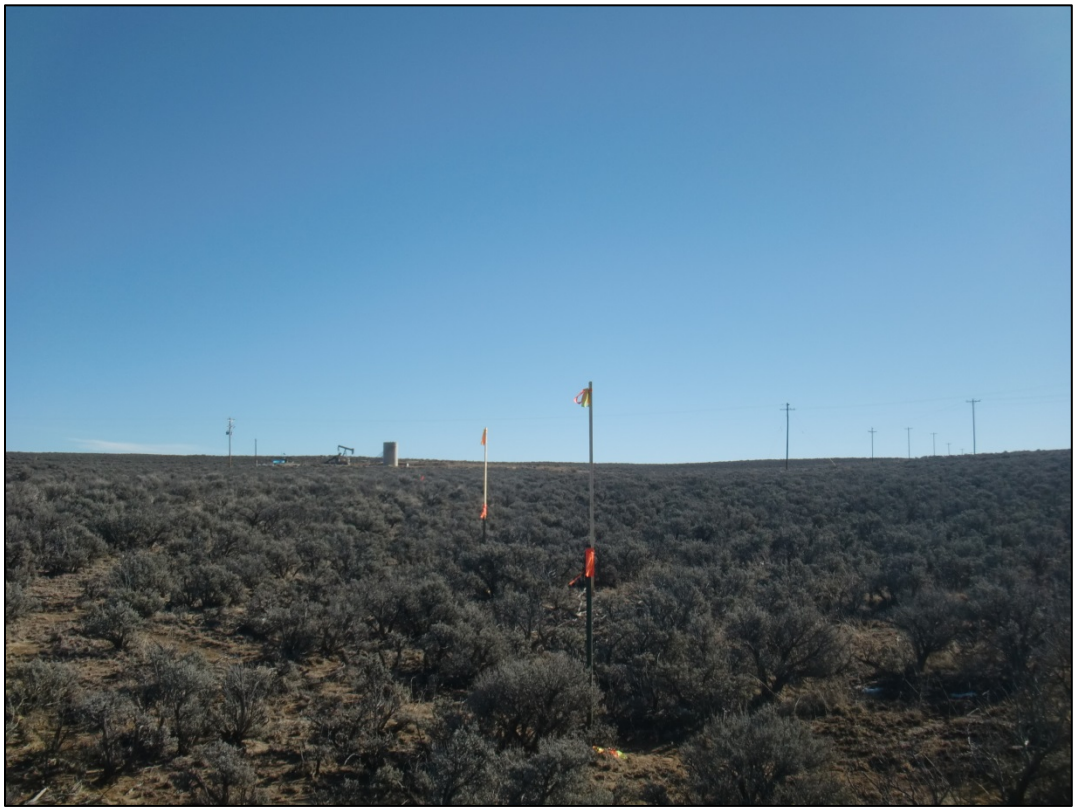
Well Pad: View from wellheads, looking northward



Well Pad: View from wellheads, looking southward

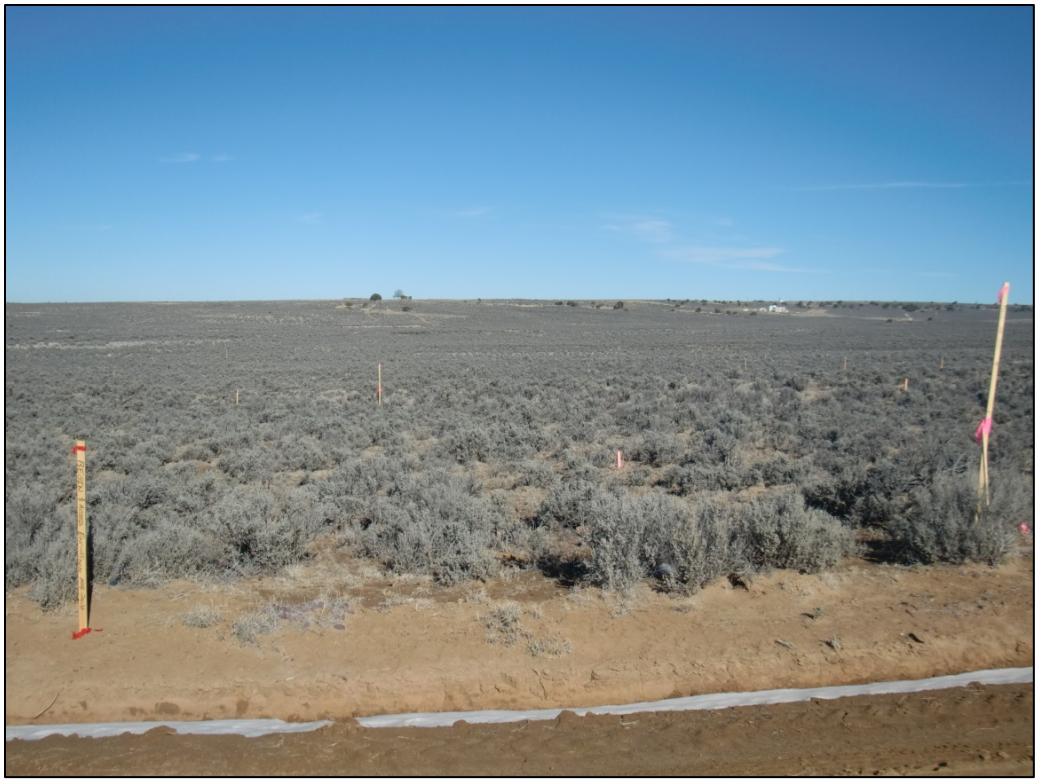


Well Pad: View from wellheads, looking westward



Well Pad: View from wellheads, looking eastward

Access Road and Well-Connect Pipeline Corridor: View from northern terminus of access road at well pad, looking southward



Access Road and Well-Connect Pipeline Corridor: View from southern terminus of access road, looking northward

Existing Road to be Upgraded and Well-Connect Pipeline Corridor: View from western terminus of road upgrade and start of access road, looking eastward

Existing Road to be Upgraded and Well-Connect Pipeline Corridor: View from central portion of road upgrade, looking northward

Existing Fence to be Relocated: View from fence corner within well pad, looking northward along fence line and two-track road

Existing Fence to be Relocated: View from fence corner within well pad, looking westward along fence line and two-track road

APPENDIX E. RECLAMATION PLAN